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Evaluation of the Use of Healing Imagery in Athletic Injury Rehabilitation

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EVALUATION OF THE USE OF HEALING IMAGERY IN ATHLETIC INJURY REHABILITATION

by

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Abstract

Healing imagery can be defined as both visualizing affirmative images of internal physiological healing occurring in an injured area and visualizing oneself as healthy and fully functioning (Driediger, Hall, & Callow, 2006). Healing imagery has been found to effectively reduce the time of recovery from various athletic injuries when used in combination with other mental skills, such as self-talk and relaxation (Ievleva & Orlick, 1991). However, the literature remains void of a study that specifically examines healing imagery and the potential benefits that may accompany the regular application of healing imagery techniques alone. This study examined the effects of an imagery intervention on the recovery of athletes experiencing an athletic injury in comparison to a control group who did not receive the imagery manipulation. The purpose of the present study was to determine the effectiveness of a healing imagery intervention through comparing the two groups on: satisfaction with rehabilitation, self-efficacy to recover, and recovery time. The sample consisted of 13 injured varsity athletes (intervention group, n=6; control group, n=7) utilizing the athletic therapy services at Wilfrid Laurier University. A significant interaction effect was found for satisfaction with rehabilitation, as athletes' in the intervention group increased in satisfaction from week 2 to 3 while the control group decreased in satisfaction during the same time period. The intervention group also used significantly more cognitive imagery than the control group. Both groups were found to be significantly higher in task self-efficacy than coping self-efficacy during injury rehabilitation. A follow-up qualitative analysis of the intervention group revealed that the healing imagery intervention positively affected athletes' in a unique, individualized manner. Results are discussed with respect to a gained understanding of imagery effects, study limitations, and future directions.

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Imagery, or visualization, is a mental skill that is used by individuals to help perform a desired task or scenario. Driediger, Hall, and Callow (2006) defined imagery as: "cognitively reproducing or visualizing an object, scene or sensation as though it were occurring in overt, physical reality" (p. 261). Overall, imagery's intended goal is to contribute positively to performance results (Gregg, Hall, & Hanton, 2007; Vealey & Greenleaf, 2006). Imagery is well established in the realm of athletics as athletes' use the mental technique to practice skills, increase self-confidence, increase motivation, increase attentional control, and lower anxiety (Vealey & Greenleaf, 2006). However, while used extensively within mental skills training programs, currently there is a limited amount of empirical evidence that evaluates imagery effectiveness in a controlled setting. Even less of this research is aimed toward injury rehabilitation with the bulk of research focussing on performance enhancement.

To define imagery use within sport, Paivio (1985) suggested that imagery exists for either cognitive or motivational purposes, with both types operating at a specific and general level. The four levels of imagery established were: cognitive specific, cognitive general, motivational specific, and motivational general. This model was later expanded by Hall, Mack, Paivio, and Hausenblas (1998) during the development of an imagery measurement tool, the Sport Imagery Questionnaire. Cognitive imagery is generally applied to the rehearsal of physical skills where motivational imagery is generally aimed at emotionally affecting the athlete. Cognitive specific imagery is used to rehearse specific sport skills, such as shooting a free-throw in basketball. Cognitive general imagery is applied to rehearse specific plays or combination skills, such as executing a break-out from the defensive zone in hockey. Motivational specific imagery is envisioning specific goals being attained, for example, winning a regional championship (Paivio, 1985; Hall et al., 1998). Further investigation by Hall et al. (1998) found that motivational

general imagery could effectively be divided into two separate subtypes; motivational general-arousal and motivational general-mastery. Motivational general-arousal imagery is applied to control arousal and stress levels while limiting anxiety. Motivational general-mastery imagery is applied by athletes to envision themselves as mentally tough and confident while competing (Driediger et al., 2006; Hall et al., 1998).

Imagery use in sport is a personalized practice that has the ability to affect each athlete in their own individual, distinctive manner. Much of the effect that imagery has on the athlete is from personal belief and interpretation of the mental skill. In a comprehensive review of six national level heptathletes' imagery tendencies, Gregg et al. (2007) found that these athletes reported using motivational general-arousal the most often while using motivational general-specific to confirm goals the least often. These athletes reported imagery as most important for controlling arousal levels. In addition, a study looking at high school basketball players competing at bantam, midget, and juvenile levels found that motivational general-mastery was reported to be used the most often for sport (Cumming, Hall, & Shambrook, 2004). Imagery has been reported to be used more often in competition than in practice (Gregg et al., 2007; Hall et al., 2009). Imagery before competition is commonly used to bring athletes into their desired mindset for performance success, as motivational general functions are found to be applied the most often in this environment. Imagery use in practice can be aimed towards learning new skills and sensations effectively, or most often for cognitive functions aimed to improve physical performance (Gregg et al., 2007). Imagery is not only reported to be used more often during the competitive season, but it was also reported to be more effective in the competitive season than in the off season. The next most common setting in which imagery is reported to be used in addition to competition and practice is while lying in bed immediately before falling asleep. It is

in this setting that athletes maintain that their imagery sessions last the longest (Gregg et al., 2007).

Imagery should aim to be polysensory in order to create images that are as realistic and, therefore, as real-life applicable as possible. The two senses that should be primarily included in an image are the visual and kinaesthetic senses, as they will provide the athlete with the most useful sensory feedback. However, the more senses able to be included in the image, the more it will mimic reality and prepare the athlete for the actual event they are preparing for (Vealey & Greenleaf, 2006). While performing imagery, Vealey and Greenleaf (2006) establish two main perspectives athletes can use to visualize themselves; external and internal. External imagery refers to an athlete viewing the image from outside their body, or from the perspective of a video camera. External is more likely to correspond to the visual sense as an athlete watches and critically analyzes their performance from a third-person view. Internal imagery refers to an athlete viewing an image from their own eyes, or as if they are actually performing the event. Internal corresponds to the kinaesthetic sense as the athlete judges how their performance feels. Since this type of image is more applicable to a real life situation, it is more likely to increase neuromuscular activity. While internal is able to mimic the actual movement to a greater degree, the perspective used by the athlete should be based on their personal preference as they should use whatever they feel benefits them to a greater degree (Vealey & Greenleaf, 2006).

To develop efficient, effective imagery practices that athletes can tailor to their own specific needs, two key areas of images must be mastered: vividness and controllability (Vealey & Greenleaf, 2006). Controllability can be defined as: "the ability of athletes to imagine exactly what they intend to imagine and to manipulate aspects of the images" (Vealey & Greenleaf, 2006, p. 323). With increased controllability, athletes develop the ability to direct imagery to the

exact area that needs to be improved upon, which in turn increases the effectiveness of the imagery (Gregg et al., 2007). Vividness can be described as: "how clear athletes can see an image and how detailed the image appears to them" (Vealey & Greenleaf, 2006, p.322). Vividness can be increased by fixing attention on detailed sensory input and emotions felt while partaking in imagery. Athletes report that imagery ability differs based on the individuals' confidence and experience levels. Imagery has been reported to be more effective when athletes are more confident and comfortable with their skills and competing environment. Athletes also state that imagery ability improves as their physical skills improve. In addition to physical experience, athletes state that imagery ability effectively improves the greater they use the techniques (Gregg et al., 2007). Imagery is not a practice that offers direct results. Athletes must develop their grasp of imagery over time and work to possess the self-awareness necessary to create relevant, beneficial imagery (Vealey & Greenleaf, 2006).

Imagery effectively works as a method that allows athletes to gain the confidence necessary to perform successfully. The practice of imagery is able to familiarize athletes with crucial skills and situations needed in competition (Vealey & Greenleaf, 2006). In the study by Cumming et al. (2004), of the group of high school, female basketball players of varying competitive levels that were introduced to imagery techniques, 61.11% reported an improvement in their skills or game performance, 19.44% reported greater levels of concentration, and 8.33% reported higher levels of confidence. In addition to performance benefits, imagery can provide such emotional benefits as increased motivation and lower anxiety (Vealey & Greenleaf, 2006). Overall, imagery is a mental skill that athletes can harness to add an extra dimension to their training routine that may serve to create the advantage needed to rise above the competition.

While imagery is a well-accepted practice in the sport performance domain, athletes do not apply it as often in injury rehabilitation that occurs as a result of sport involvement (Driediger et al., 2006; Sordoni, Hall, & Forwell, 2002). In a preliminary study investigating the use of mental skills in athletic injury rehabilitation, Ievleva and Orlick (1991) found that individuals that healed the fastest used significantly more imagery, goal setting, and positive self-talk. Not only did these athletes heal in a shorter period of time but they reported greater feelings of personal control over the healing process, had more positive associations to the rehabilitation process, and displayed less fear of reinjury while returning to sport. With respect to the exclusive application of imagery in an intervention, Cupal and Brewer (2001) reported that individuals that endured an intervention of guided imagery and relaxation exhibited significantly higher strength in their surgically-repaired knees at 24 weeks post-surgery than both the placebo and control group. Not only did these athletes display positive physical benefits but they reported less pain and lower feelings of reinjury anxiety (Cupal & Brewer, 2001). Christakou, Zervas, and Lavelle (2007) found that athletes who used cognitive imagery and relaxation techniques showed significantly higher scores on tests of muscular endurance and balance stability.

The qualitative review done by Driediger et al. (2006) revealed that of those athletes who used imagery in injury rehabilitation without an outside intervention, the context in which imagery was used was very limited. Athletes reported that they used motivational imagery the most often and felt that it was the most important type of imagery. The athletes reported using motivational imagery both on the specific level to affirm their rehabilitation goals and on the general level to limit anxiety and remain mentally tough. Athletes' temporal application of imagery was also found to be very limited as the most common time for imagery use was while rehabilitation exercises were being performed. The use of imagery before and after

physiotherapy sessions was also found to be restricted as it was used most often during physiotherapy sessions (Driediger et al., 2006). In addition to athletes' limited perspective of imagery use during rehabilitation, physiotherapists may view the mental skill as unlikely to contribute positively to the recovery process. In a study by Francis, Anderson, and Maley (2000), male athletes and physiotherapists were asked to rank 12 mental skills based on their effectiveness to facilitate an athlete's ability to psychologically deal with an injury. Of the 12 strategies available, relaxation and imagery ranked the lowest in perceived ability to help athletes cope with injuries. When questioning only the physiotherapists about vital strategies for treating injured athletes, of 12 items available, teaching muscle relaxation and teaching mental imagery were considered the least important (Francis et al., 2000).

The analysis of imagery use in injury rehabilitation also revealed the use of a new division of imagery specific to the recovery process. Healing imagery was found to be a form of imagery that athletes exercised in conjunction with cognitive and motivational imagery (Driediger et al., 2006). Healing imagery was also identified and acknowledged in a number of other articles in the literature (Evans, Hare, & Mullen, 2006; Ievleva & Orlick, 1991; Law, Driediger, Hall, & Forwell, 2006; Milne, Hall, & Forwell, 2005; Sordoni et al., 2002). The analysis done by Driediger et al. (2006) revealed that in injury rehabilitation, athletes used imagery for cognitive, motivational, and healing purposes. In addition, they suggested that divisions of imagery also existed for pain management and injury prevention purposes, which expanded upon the three aforementioned divisions originally recommended by Sordoni et al. (2002). Heil (1993) describes the use of healing imagery as creating images that represent a disease or an injury, the resulting physiological coping response, and the physiological effect that accompanies the prescribed treatment. Driediger et al. (2006) describe healing imagery for injury

rehabilitation purposes as visualization of the injury undergoing internal, physiological healing. External healing imagery also exists as it can consist as picturing the body healthy and competing in sport once again (Driediger et al., 2006).

The use of healing imagery to influence internal physiological responses has been extensively studied in medical literature. Simonton, Matthews-Simonton, and Creighton (1978) introduced a group of terminally ill cancer patients to a program of imagery and relaxation. The imagery and relaxation program was found to show overall improvement in the health status of 41% of participants, while 22.2% went into remission, and an amazing 19.1% experienced a regression of their tumours. In a study concentrated on pain associated with cancer, an intervention of guided imagery was found to decrease the average intensity of pain in 90% of the experimental group (Kwekkeboom, Kneip, & Pearson, 2003). Donaldson (2000) prescribed terminally ill patients who had low white blood cells counts to a daily guided imagery program that was administered through audiotape. The treatment group initially showed a decrease in white blood cell count but then displayed a significant increase over time as participants became more relaxed and in control of their imagery. Healing imagery has been found to physically boost immune system function as displayed through increased activation of helper T cells (Jasnowski & Kugler, 1987) as well as through increased production m-IgA in the saliva (Gregson, Roberts, & Amiri, 1996).

Though the literature involving healing imagery in the management of disease is quite extensive, research on healing imagery use in athletic injury rehabilitation remains sparse (Driediger et al., 2006). The study conducted by Ievleva and Orlick (1991) found that athletes reported healing imagery as the most effective and important type of imagery they used, as it was the most strongly related to the quickest healing times. Sordoni et al. (2002) expanded on a

previous study by Sordoni, Hall, and Forwell (2000) to include measuring the frequency of healing imagery use in injury rehabilitation in addition to cognitive and motivational imagery use. Sordoni et al. (2002) found that healing imagery was the only type of imagery significantly related to self-efficacy, supporting Ievleva and Orlick's (1991) finding that fast healers took greater personal responsibility for their healing and felt greater personal control over the healing process. Law et al. (2006) identified that healing imagery was positively correlated to injured athletes' perceptions of imagery as an effective tool for pain management. However, the majority of the recent literature specific to healing imagery in athletic injury has aimed to identify its frequency of use rather than evaluating if it significantly enhances rehabilitation results and overall experience. Sordoni et al. (2002) reported that athletes used the three types of imagery an equal amount, where as various studies reported that healing imagery was used less frequently by athletes in rehabilitation than cognitive and motivational imagery (Driediger et al., 2006; Law et al., 2006; Milne et al., 2005). These results indicate that athletes may not possess the awareness of the possible benefits of healing imagery or believe that they have the ability to effectively perform healing imagery (Milne et al., 2005). Additionally, in a survey of athletic therapists and physiotherapists across America regarding their opinions on the effectiveness of imagery use, the item corresponding to healing imagery ranked the second lowest in the imagery field. The results of this study indicate that professionals in these practices do not perceive healing imagery techniques to be especially useful and effective, denoting that they would probably be less likely to apply them in a practical setting (Hamson-Utley, Martin, & Walters, 2008).

Since healing imagery has displayed a strong correlation to self-efficacy and feelings of control, its use could serve as an effective practice to empower the patient. The process of empowering patients with advanced healing imagery skills could translate positively to such

benefits as a shorter recovery time and a greater overall experience in rehabilitation. When an individual applies healing imagery, they do so with the belief that they can cast a personal influence on the body's natural healing process. This element to healing imagery has been supported through findings that its use is significantly related to feelings of self-efficacy (Ievleva & Orlick, 1991; Sordoni et al., 2002). Self-efficacy can be defined as an individual's belief in their own capability to perform a certain task (Bandura, 1997). Ievleva and Orlick (1991) found that those who healed the fastest reported using a significantly greater amount of healing imagery than those who healed in an average or slow amount of time. During later qualitative analysis, athletes in the fast healing group generally reported that they had a feeling of control over the healing process. On the other side of the spectrum, the slow healing group reported they perceived healing as something that just happens to you or a process that you can exude little influence upon (Ievleva & Orlick, 1991). Sordoni et al. (2002) suggest that these reports from athletes in the study by Ievleva and Orlick (1991) indicate that the use of healing imagery was positively related to self-efficacy, or their feelings of self-confidence and personal control.

Sordoni et al. (2002) was one of the first efforts for empirical examination of both self-efficacy and imagery use in injury rehabilitation. Sordoni et al. (2002) utilized the Injury Self-Efficacy Questionnaire (ISEQ), a 10-item measure that included perceptions of task, scheduling, and barrier efficacy. Task efficacy refers to one's beliefs of their capabilities in a certain situation. Barrier efficacy refers to one's belief in their ability to surmount social, personal, and environmental issues. Scheduling efficacy refers to one's ability to plan strategies for executing exercises (Bandura, 1997; Sordoni et al., 2002). Questions relating to type of efficacy were answered on a scale ranging from 0% confidence to 100% confidence. A factor analytical technique performed resulted in a one-factor solution for self-efficacy. Thus, statistically, the

three types of self-efficacy did not significantly differ from each other. As a result, the authors considered self-efficacy as one measure that they tagged as athletic injury rehabilitation self-efficacy. While athletes registered overall high levels of self-efficacy during rehabilitation, only healing imagery was found to be significantly correlated with self-efficacy, not motivational or cognitive imagery. A Pearson's correlation coefficient of .21 found that healing imagery was significantly related to self-efficacy (Sordoni et al., 2002).

Contrary to the findings of Sordoni et al. (2002), analysis done by Milne et al. (2005) on the ISEQ (referred to in this article as the Athletic Injury Self-Efficacy Questionnaire or AISEQ) revealed a two-factor solution. Instead of using the three divisions of self-efficacy, Milne et al. (2005) combined barrier and scheduling efficacy into one division called coping efficacy, building off the recommendation by Maddux (1995) that the two types were alike because they were both largely self-regulatory. The authors found a significant difference between task and coping self-efficacy in their first study conducted for the article, with the second study maintaining that there indeed was a difference between task and coping self-efficacy. The results showed that athletes used more task than coping efficacy and also displayed greater use of cognitive and motivational imagery than healing imagery. However, the only significant relationship found between imagery and self-efficacy was that cognitive imagery was related to task efficacy. Healing imagery was not found to be a strong predictor of task or coping efficacy (Milne et al., 2005). Due to the mixed findings apparent in the current literature, self-efficacy was evaluated to determine how it is related to the use of healing imagery.

A strength of previous prospective quantitative studies in which imagery interventions were applied was that all athletes' injuries were consistent. Injuries were all grade II ankle sprains, of which athletes had a partial tear of the anterior and posterior talofibular ligament or of

the deltoid ligament, that were diagnosed by the same physician (Christakou & Zervas, 2007; Christakou et al., 2007). Other studies used athletes who were recovering from reconstructive anterior collateral ligament (ACL) surgery (Cupal & Brewer, 2001). Ievleva and Orlick (1991) elected to use both grade II ankle sprains and grade II medial collateral ligament (MCL) sprains because of the similarities in the injury's debilitating factors and expected recovery time. Authors who utilized a retrospective approach to identify imagery use in injury rehabilitation elected to include athletes with any type of injury that required a rehabilitation process (Milne et al., 2005; Sordoni et al., 2000; Sordoni et al., 2002). Other studies used athletes who had an injury of the leg, knee, ankle, or foot and were asked to complete a 20-item Lower Extremity Functioning Scale questionnaire to evaluate how the injury affected their activities of daily living (Law et al., 2006). This method by Law et al. (2006) allowed for a sample size large enough to create an acceptable level of power, but saw a great range in the time athletes spent in rehabilitation (1 week to 288 weeks). The aim of the current study was to use athletes with the same type of injury to maintain a high level of consistency among participants.

The type of injury under analysis also has important implications as imagery use can vary according to the temporal stage of the rehabilitation process. Evans et al. (2006) addressed the time period of rehabilitation and how it affected imagery use. In the early stage of rehabilitation, or first 3 weeks of injury, athletes reported using imagery for healing purposes, as well as for pain, cognitive, and motivational purposes. However, athletes reported that negative emotions from recently being injured affected their ability to perform imagery. Three participants of four noted problems of injury flashbacks when imagery was attempted (Evans et al., 2006). This phenomenon presented a problem with conducting imagery in this period as Ievleva and Orlick (1991) reported that healing imagery only positively related to a faster recovery time if the

individuals were not affected by injury-replay imagery. The mid phase of injury, or the middle 2-3 weeks of rehabilitation, athletes reported that their ability to use healing imagery greatly improved from the early phase as they put forth more energy to the recovery process and less towards grieving (Evans et al., 2006). Subsequently, the end phase of rehabilitation, or 2-3 weeks returning to sport, none of the athletes used imagery for healing and pain, it was directed mostly towards sport use (Evans et al., 2006). The current study controlled for negative imagery by guiding participants through the healing imagery with the help of an imagery script. This provided the athlete with direction in their imagery practices, preventing their mind from focusing on negative images. Also, athletes with similar types of injuries were attempted to be recruited as injury severity may affect the effectiveness of imagery application.

In addition to using the same type of injury, Christakou and Zervas (2007) and Christakou et al. (2007) maintained consistency among study participants by excluding individuals who had previous injuries to the ankles. This level of consistency would be beneficial to the internal validity of the current study as healing and recovery times may be influenced through familiarity with the rehabilitation experience. Athletes who have previous experience in rehabilitation may be more in tune with what they need to focus on to enhance the process of recovery. Milne et al. (2005) found that athletes who had experienced three or more previous injuries displayed a higher level of self-efficacy in their current rehabilitation. Injury can be initially accompanied with an array of negative emotions, such as frustration and depression (Tracey, 2003). Athletes with previous rehabilitation experience may exhibit a greater awareness of the psychological challenges that accompany an injury and may be more able to effectively overcome these emotions (Johnson, 1996). Those who had previous experience in rehabilitation were attempted to be excluded from the present study.

An imagery intervention program should be established to ensure that participants' imagery abilities are equal, controlling for the threat to internal validity of having previous experience in imagery. Sordoni et al. (2002) found that previous use of imagery in sport and in rehabilitation was significantly positively correlated to athletes' current use of imagery in rehabilitation. A players' level of competition has been found to be a key factor in the use of imagery, as more advanced, elite athletes have been found to use significantly more imagery than recreational athletes (Cumming et al., 2004; Gregg et al., 2006; Vealey & Greenleaf, 2006). In a study that was directed to determine the effectiveness of imagery workshops on teenage basketball players, Cumming et al. (2004) reported that an imagery intervention resulted in the athletes using significantly more imagery for their sport. An astounding majority of 94.4% of athletes reported that they felt imagery use benefited their overall performance. The authors also discovered that an imagery intervention as short as one session can increase an athlete's use of imagery (Cumming et al., 2004).

In studies by Christakou and Zervas (2007) and Christakou et al. (2007), the researchers initially established that athletes were familiar with imagery use at the beginning of rehabilitation. After gathering this information, they then introduced participants in the experimental group to a 12-session imagery intervention where each session lasted 45 minutes. These two studies based their imagery interventions on the visualization of performing rehabilitation exercises or a specific movement (Christakou & Zervas, 2007; Christakou et al., 2007); which would relate to cognitive specific imagery (Hall et al., 1998). Participants in the intervention group were also asked to perform the imagery sessions at home, keeping an imagery log to record the fine details of the session (Christakou et al., 2007). Cupal and Brewer (2001) chose to use a 10-session guided imagery and relaxation intervention that entailed participants to

listen to a planned audiotape. These individuals were also instructed to listen to the tapes at home and record how often they did so in an imagery log. In the study by Christakou et al. (2007), the goal of the first four sessions was to educate athletes about imagery and how it could be used in injury rehabilitation. In particular, participants were guided through a number of exercises and instructions that worked to enhance their controllability and vividness of their imagery as well as their self-awareness during rehabilitation exercises. The participants displayed improvement in their imagery ability over the first three sessions, with their abilities remaining constantly high through the following sessions (Christakou & Zervas, 2007; Christakou et al., 2007). The success of these aforementioned studies provide evidence that a multiple session intervention program would benefit the internal validity and positively influence the results of the study as all participants would be able to become more accustomed to imagery use. The current study used an imagery intervention of three sessions per week until the athlete returned to sport to ensure that the participants in the experimental group developed a high imagery ability that was consistent across the group.

A healing imagery intervention must be specific to the individual injury and the processes that are taking place in the body. These natural processes become the basis of what is to be imagined in internal healing imagery. To develop this specificity, the educational stage of the imagery intervention program must include information about the body's coping response to the injury, what the exact damage to the anatomical structure entails, and how the rehabilitation exercises will work to correct this damage. Multiple authors have suggested that an individual will be able to create imagery that is increasingly vivid as their physiological and anatomical knowledge of the injury expands (Evans et al., 2006; Green, 1999; Heil, 1993; Sordoni et al., 2002). Heil (1993) suggests that healing imagery could be more easily created if athletes know

exactly what is physiologically transpiring and are able to confidently describe what is happening in their body both after the injury and throughout the treatment process. Milne et al. (2005) suggested that athletes were found to use both cognitive and motivational imagery more frequently than healing imagery because they were uncertain of what to image. It is through the interaction with the health practitioner that athletes are able to gain the knowledge that will fuel the content of their healing imagery (Milne et al., 2005; Sordoni et al., 2002). Milne et al. (2005) further recommended that physiotherapists should explain the injury and how it will heal in immense detail to improve the athlete's ability to use healing imagery.

The imagery intervention sessions created by Cupal and Brewer (2001) developed their participants' understanding through concentrating on the specific stage of the healing process while attending to the accompanied physiological processes and by giving participants the opportunity to add suggestions to improve their coping responses to the injury. The authors were able to successfully add to athletes' imagery abilities through the viewing of arthroscopic videotapes of their reconstructed ligament (Cupal & Brewer, 2001). Sordoni et al. (2002) suggested that physiotherapists should incorporate pictures and anatomical models into their explanation of the injury to give athletes a basis to create healing imagery. Overall, for healing imagery to be as effective as possible, the athlete must be properly educated through extensive descriptive and visual representations of the injury. When using healing imagery, the athlete must feel confident that they possess the knowledge and understanding to make vivid, helpful images. The current study worked to educate the participants in the experimental group through information of the stages of soft tissue healing and various visual tools, such as still images and an anatomical computer program. Participant education as well as specific imagery scripts were utilized to form the content of the healing imagery.

An imagery measurement tool that has application for assessing an athletes' frequency of healing imagery use is the Athletic Injury Imagery Questionnaire-2 (AIIQ-2) developed by Sordoni et al. (2002). The AIIQ-2 is a three section questionnaire that evaluates athletes' current use of cognitive, motivational, and healing imagery in injury rehabilitation (Sordoni et al., 2002). Motivation imagery had a Cronbach alpha reliability coefficient of .82, cognitive had .84, and healing had .91, well above the criterion level of .70 (Sordoni et al., 2002). Reliability of the AIIQ-2 was also found to be acceptable by Milne et al. (2005).

Driediger et al. (2006) expressed criticism about the AIIQ-2 as an accurate measure of imagery use; however they chose to use the measure to supplement their qualitative approach. The authors chose to unearth imagery use in rehabilitation through primarily qualitative methods stating that both the AIIQ (Sordoni et al., 2000) and AIIQ-2 were developed based on theories of athletes' imagery use in competition and practice, not on grounded theory of athletes' imagery use in injury rehabilitation (Driediger et al., 2006). Driediger et al. (2006) suggest that the AIIQ-2 needs to add sections for pain management and injury prevention imagery in addition to the sections on cognitive, motivational, and healing imagery. The authors also advised that the AIIQ-2 should include more injury specific questions to make the measure more accurate (Driediger et al., 2006). Evans et al. (2006) recommend that the AIIQ-2 should be improved through including participants' perceptions of what the purpose of the imagery is so that it can be correctly categorized to the right subtype of imagery. This recommendation is consistent with that of Short, Monsma, and Short (2004) who state that the intended goal of the imagery should be recorded. Regardless of these factors, the AIIQ-2 still stands as the best quantitative questionnaire to assess athletes' frequency of imagery use prior to and during injury rehabilitation. The current study used part B of the AIIQ-2 to establish athletes' previous use and

experience with imagery techniques. The measure provided information on athletes' imaging familiarity gained from previous use in sport.

Since the use of the AIIQ-2 has been used only retrospectively in the literature to identify frequency of imagery use, a separate measurement tool must be used to determine athletes' imagery ability. Christakou et al. (2007) initially determined imagery ability through the completion of a Vividness of Movement Imagery Questionnaire, which asked the athletes to rank how clear and vivid their movement images were on a 5-point Likert scale (Christakou et al., 2007). In the following intervention sessions, the authors asked athletes to complete a manipulation check that used a 5-point scale to determine how well they could clearly and vividly imagine movements. Through these manipulation checks, the researchers were able to identify that imagery ability was improving throughout the intervention (Christakou et al., 2007). The current study created a manipulation check similar to that of Christakou et al. (2007). However, instead of measuring movement imagery ability, the manipulation check determined vividness, controllability, and the degree to which the visual and kinaesthetic senses were included in the participants' imagery. The series questions in the manipulation check were directly related to the imagery the participants conducted for the study. The check also evaluated the participants' ability to create internal and external healing imagery.

Imagery use during injury rehabilitation may create an overall more enjoyable experience for the athlete. Law et al. (2006) found that athletes who reported using imagery for pain management were found to be significantly more satisfied with their rehabilitation experience. Ievleva and Orlick (1991) also reported that those who healed the fastest also had more positive associations to the rehabilitation process. Imagery use may allow athletes' to become more mentally engaged in the rehabilitation and recovery process. Similar to self-efficacy, healing

imagery may also increase feelings of satisfaction with rehabilitation as the athletes would perceive a greater level of personal influence over the healing process. Athletes could benefit from increased satisfaction as they would emerge from rehabilitation and return to sport with a more positive attitude, which may aid in the transfer process as the athletes would be able to focus on sport to a greater extent and not negatively dwell on the rehabilitation process. The present study examined the effect that healing imagery application has on satisfaction with rehabilitation to determine if it was able to leave athletes more content with the overall process during their recovery.

Finally, in order to determine if healing imagery is able to enhance the recovery process of the injured athlete, the present study measured time of recovery. Ievleva and Orlick (1991) is one of the few research articles in imagery use in injury rehabilitation that use time of recovery as a measure of imagery's effectiveness. The researchers defined the term recovered as the injured athlete returning to 85-90% of their original level of functioning. The level of functioning was determined by the physiotherapist through a number of physical tests and by athletes' self-report. The physical tests used by the physiotherapist measured strength, range of motion, and degree of tenderness. The results were compared to the opposite, healthy limb (Ievleva & Orlick, 1991). Rehabilitation can be considered effective if athletes are able to return to their sport at a faster rate and perform with a physically healthy body. The current study used measurements of recovery similar to Ievleva and Orlick (1991) as physical tests will be used to determine 90% functioning of the injured limb in comparison to the healthy limb. Athletes' self-report was used in addition to the physical tests, coming through a daily sport activity journal that covered their sport related activity and accompanied disability from injury in detail.

The purpose of the present study was to evaluate the effectiveness of a healing imagery intervention program in aiding recovery from athletic injury. The imagery program, developed from previous research, was polysensory, aimed to enhance vividness and controllability, and was based on creating images that visualized the injury undergoing internal, physiological healing as well as external images of picturing the athlete becoming healthy and returning to sport. The well-developed measures of the Athletic Injury Self-Efficacy Questionnaire (AISEQ) and the Athletic Injury Imagery Questionnaire-2 (AIIQ-2) were used throughout the intervention program to evaluate athletes' self-efficacy and frequency of imagery use. Participants' imagery ability was also evaluated throughout the recovery process. The intervention and control group were compared on the recovery time needed to effectively rehabilitate, satisfaction with the rehabilitation program, and self-efficacy appraisals of ability to recover (AISEQ). A qualitative analysis was also conducted with the intervention group to further explore the participants' perceptions of the effect of the imagery intervention on their recovery. It was hypothesized that the imagery group would show a shorter time of recovery, a greater satisfaction with injury rehabilitation, and greater levels of self-efficacy to recover.

Methods

Participants

Participants were 13 varsity athletes utilizing the athletic therapy services at Wilfrid Laurier University. There were 6 participants in the intervention group and 7 participants in the control group. Quota sampling techniques were used to assign the participants into the intervention or control group.

The intervention group ranged in age from 20 to 22 (M= 20.67, SD= 0.82). The group was comprised of four males and two females. Athletes in the intervention group were receiving treatment for grade II anterior talofibular ligament sprains (n=2), grade II acromioclavicular ligament sprain (n=1), grade III anterior cruciate ligament sprain (n=1), grade II anterior talofibular and posterior talofibular ligament sprain (n=1), and grade II medial collateral ligament sprain (n=1). Two athletes were receiving treatment on their right limbs and four were receiving treatment on their left limbs. The intervention group competed in soccer (n=3), volleyball (n=2), and rugby (n=1). Five athletes described themselves as starters while one described themselves as playing a limited amount of time. Five athletes in the intervention group had previously been seriously injured and had previous rehabilitation experience while only one participant indicated that they had experienced no previous injury or rehabilitation. Most importantly, no participants in the intervention group reported that they had previously used imagery in the recovery from injury (n=6).

The control group ranged in age from 19 to 21 (M= 19.71, SD= 0.76). The group was comprised of three males and four females. Athletes in the control group received treatment for grade II anterior talofibular ligament sprains (n=2), complete elbow dislocation (n=1), fractured talus bone (n=1), grade II hamstring strain (n=1), grade II medial collateral ligament strain (n=1),

and lateral tibial plateau bone bruise (n=1). Four athletes were receiving treatment on their right limbs and three athletes were receiving treatment on their left limbs. The control group competed in soccer (n=3), baseball (n=2), cheerleading (n=1), and football (n=1). Six athletes described themselves as starters while one athlete stated that they played often but did not start. Similar to the intervention group, six athletes in the control group had previously been seriously injured and had previous rehabilitation experience while one did not have any experience with injury or rehabilitation. Interestingly, two participants stated that they had previously used imagery for injury recovery while five stated that they had not used imagery for injury recovery.

Control and Intervention Group Measures

Demographic Information

Athletes in the control and intervention group were both given pre-study assessment forms (see Appendix A). The pre-study assessment forms gathered information on the athletes' current involvement in sport, the severity of their current injury, their injury history, and their previous experience with injury rehabilitation.

Recovery Time

Athletes' self-report was used to determine recovery time. The Daily Sport Activity Journal (DSAJ; see Appendix B) required the athlete to record any type of sport related activity they took part in as well as the duration and the intensity of the activity. The DSAJ was used to determine recovery time. Full recovery was determined when the athlete was able to return to their pre-injury physical activity level at full intensity for three uninterrupted days, without any limitations from the pain and disability of injury.

Physical tests of strength and flexibility were done as secondary measures to provide information on the physical state of the limb. Strength tests were done on a Cybex dynamometer

by the researcher in the plane of motion that most closely corresponded to the participants' specific injury. For example, athletes with grade II anterior talofibular sprains were subject to strength tests of ankle inversion and eversion. Athletes were given a 5-minute tutorial on how the Cybex dynamometer measured strength. Following set-up of the machine, athletes were given four sets of practice on each limb before the testing set. Following the practice, the researcher ensured that the athlete felt competent on the machine. The researcher also ensured that the athlete was comfortable with conducting five maximal repetitions on their injured and healthy limb. Flexibility tests were done by the athletic therapist using a manual goniometer in the plane of motion that best corresponded to the injury in question.

Results of the strength and flexibility tests of the injured limb were compared to that of the healthy limb. Strength recovery was deemed complete when the injured limb regained the strength and flexibility of 90% of the healthy limb. The level of 90% was used to combat differences that would be apparent from limb preference.

Overall Satisfaction with the Rehabilitation Experience

Athletes in both the intervention and control group completed the Overall Satisfaction with Rehabilitation Scale (OSWRS) during weekly sessions with the researcher. The 5-item questionnaire assessed athletes' personal feelings of satisfaction surrounding their recovery. Participants ranked their feelings of satisfaction on a 7-point Likert scale (see Appendix C). This is a newly developed scale by the researcher that was evaluated for content validity by an expert in the field before use.

Self-Efficacy to Recover

Athletes in both the intervention and control group completed the AISEQ during weekly sessions with the researcher. The 10-item questionnaire assessed athletes' personal perceptions

of their ability to persevere through rehabilitation and effectively conduct rehabilitation exercises. The questionnaire by Milne et al. (2005) measured task (3 items), barrier (3 items), and scheduling self-efficacy (4 items). Participants ranked their confidence in their abilities on a scale from 0% to 100% (see Appendix D).

Imagery Intervention Group Measures

Athletic Injury Imagery Questionnaire-2 (AIIQ-2)

Part B of the AIIQ-2 was used to determine athletes' frequency of imagery use at various stages of the rehabilitation process. The 11-item questionnaire by Sordoni et al. (2002) included sections on motivational (3 items), cognitive (4 items), and healing imagery (4 items). Athletes' were asked to rank how frequently they used a given imagery measure on a 7-point Likert scale (see Appendix E). The AIIQ-2 was given to the intervention group weekly from week 2 forward. It was also given to participants in the control group in their last session with the researcher to determine their use of imagery during their rehabilitation. This is a well-developed scale with acceptable reliability (see Sordoni et al., 2002).

Imagery Ability Check (IAC)

The IAC was distributed to the intervention group weekly, beginning in week 2 of the intervention. The 9-item imagery scale determined the athletes' ability to create vivid, controllable, and polysensory imagery, as well as evaluate their ability to image internal and external healing imagery. The athletes' imagery ability was evaluated on a 7-point Likert scale (see Appendix F). This is a newly developed scale that was evaluated for content validity by an expert in the field before use.

Qualitative Imagery Follow-up

A follow-up qualitative questionnaire was given to the intervention group following the completion of the study (see Appendix G). Two months post-study completion, participants responded via e-mail to six items that inquired about the participants' experience with the imagery intervention program and how they felt it affected their recovery from injury. Participants completed the follow-up approximately 3 to 6 months post-injury. The purpose of the qualitative analysis was to allow participants to individually express and explain the effect that they believed imagery had on their rehabilitation. Five of the intervention group participants responded to the survey.

Procedure

Athletes were recruited for the study by the athletic therapists within the Wilfrid Laurier University athletic therapy clinic. Athletes were referred after their initial therapy session. Upon referral and after a brief, general description of the study was provided to the athletes in person or via e-mail, a meeting time was scheduled to fall within the first week of athletes' injury recovery. During the first meeting, the study protocol was explained to participants, athletes were assigned to a respective group, and informed consent was secured.

As previously mentioned, quota sampling techniques were used to assign participants to the intervention or control group. The original intention of the researcher was to recruit participants suffering from only grade II ankle sprains. The plan was then to assign athletes equally to the intervention and control group based upon their entrance to the study. Following the data collection period, participants were to be matched based on the similarities of their injuries. However, due to a limited number of athletes recruited in the early stages of the study, recruitment was expanded to athletes suffering from any type of grade II sprain or strain.

Matching subjects became an unrealistic goal. Instead, quota sampling was used until as many participants as possible could be recruited into both groups and time constraints could be met.

Participants in the imagery group were aware that the purpose of the study was to evaluate the effect of healing imagery on recovery from athletic injury. Participants in the control group were told that the purpose of the study was to examine weekly progress in recovery from athletic injury. They were not aware that they were being compared to an imagery group. Participants in both groups consented to their specific purpose and procedures.

The specific procedures for athletes in the control and intervention group differed with respect to exposure to the education program, imagery intervention, and imagery measures. After providing consent in the first session, the control group completed the pre-study assessment form. Participants then completed the DSAJ (see Appendix B: Figure B1) and retroactively recorded their activity levels from the day of the injury until the day of the first session. Participants recorded their activity levels once a day for the course of the rehabilitation program. Over the course of the study, the control group completed the measurement tools of AISEQ, AIIQ-2, and OSWRS. Refer to Appendix H for a detailed weekly schedule of control group testing. Control group participants were not provided with the Injury Education Program or the imagery intervention. As mentioned earlier, the control group was given the AIIQ-2 during their last session in order to evaluate their self-directed use of imagery.

The intervention group also completed a pre-study assessment sheet following completion of the consent form. They then completed the DSAJ (see Appendix B: Figure B2) and retroactively recorded their activity levels from the day of the injury until the day of the first session. Participants were then instructed to record their activity levels once a day for the course of the rehabilitation program. Over the course of the study, the intervention group completed the

AISEQ, AIIQ-2, OSWRS, and IAC on a planned weekly schedule (see Appendix I). Beginning with the first session, the intervention group received the Injury Education Program and the imagery intervention, which are both described in detail below. Athletes were instructed by the researcher to conduct healing imagery for a minimum of three times a week, including the structured imagery intervention session with the researcher. The athletes tracked their imagery days in their sport activity journal. After the conclusion of the study, participants in the intervention group completed a qualitative follow-up analysis describing their experience with imagery in the recovery from injury.

Injury Education Program

In the initial session with the researcher, participants in the intervention group were subject to the Injury Education Program (see Appendix J). The purpose of this program was to provide participants with the background information and visual representations of their injury and the healing process that would be required to accurately conduct healing imagery. The information covered in the program was included in both the internal and external healing imagery intervention.

To begin the session, the basic characteristics and limitations of the athletes' specific soft tissue injury were discussed. The researcher affirmed general attributes of ligament or muscle injuries diagnosed by the athletic therapist using simple charts that listed injury characteristics based on grade (see Appendix J: Table J1 & J2). The researcher then provided athletes with images of a strained muscle (see Appendix J: Figure J3) or a strained ligament (see Appendix J: Figure J4) based on their specific injury to represent the internal appearance of their soft tissue injury. Participants were then shown their corresponding ligament or muscle using an anatomical computer program (Acland's DVD Atlas of Human Anatomy, Lippincott Williams & Wilkins;

2003). The DVD program was used to create a visual representation how the ligament or muscle would appear when it was fully healed and intact.

The researcher then taught the participants about the process of soft tissue injury healing. The three stages of the healing process were discussed using a guide for the progression (see Appendix: Figure J5) while the participant was routinely asked if they understood the information being presented. The three stages of soft tissue injury healing include: the inflammatory phase, the proliferative phase, and the remodelling phase (Anderson, Parr, & Hall, 2009). To supplement the verbal description of the inflammatory phase of the healing process, participants were shown an image to visually represent the actions of white blood cells on the injured area (see Appendix J: Figure J6). Conversely, to supplement the description of the proliferative phase of the healing process, participants were shown a visual image to display the appearance of collagen fibres that are essential in rebuilding the soft tissue (see Appendix J: Figure J7).

After the instruction of the three stages of the healing process, participants were asked if they had a firm comprehension of the physiological processes of their bodies and were asked if they needed further clarification in any specific areas. Participants were also offered the choice to observe any visual aids a second time to ensure that they had a clear image of all covered material.

Imagery Intervention Program

The intervention program included internal and external healing imagery. Internal imagery focused on the injury and the physiological healing processes of the body. During the later stages of recovery, while the athlete was transitioning back into sport, external imagery was utilized to have the athletes picture themselves as healthy and returning to their high functioning

level. The intervention program was polysensory as it aimed to include primarily the visual and kinaesthetic senses. Internal imagery focused on developing a visual representation of the injury and the healing process. This visual representation was strengthened by the aforementioned Injury Education Program. The kinaesthetic sense was directed to focus on the physiological processes that accompany healing and how the processes physically felt, such as feeling increased blood flow to the site of the injury. During external imagery, the athlete created a visual representation of a healthy self, unaffected by their injury. To develop the kinaesthetic sense, athletes were directed to imagine their injury as fully healed, moving through everyday life without pain or disability, and being able to move around with ease.

For imagery to be optimally effective the intervention was designed to improve the vividness and controllability of the images the athletes created. Vividness was enhanced through the education program as athletes were given the criteria to create detailed images of the injury and the healing process in their minds. Controllability was enhanced through repeated imagery application early in the intervention program that introduced athletes to imagery and developed their skills to create accurate images.

The content of the imagery was standardized. The researcher facilitated the creation of images in the imagery intervention by guiding athletes through an imagery script by reading an item and giving the athlete approximately 15 seconds to conduct the image. Imagery scripts specific to internal healing imagery (see Appendix K) were used for week 1 and 2 interventions and scripts specific to external healing imagery (see Appendix L) were used for week 3-8 interventions. Upon completion of an intervention session, participants were provided with copies of the imagery script. Participants were instructed to conduct imagery three or more times per week. Scripts were provided for reference as athletes were informed they could personalize

their self-directed imagery away from the interventions. The researcher informed participants to either follow the script verbatim or conduct imagery learned in the intervention sessions that was specifically meaningful to them.

The imagery intervention program was created to follow the guidelines of successful imagery use by athletes in sport suggested by Vealey and Greenleaf (2006). The imagery program was designed to be diverse and complete, aiming to include the essential elements of vividness, controllability, visual sense, kinaesthetic sense, as well as internal and external perspectives (Vealey & Greenleaf, 2006). The timing and content of the internal and external interventions was determined to comply with the timing of the physical healing of the body. Following the average timeline for stages of soft tissue healing outlined by Anderson, Parr, and Hall (2009), the imagery intervention program was created to progressively guide athletes through the recovery process and encourage a quick, timely recovery. For example, the proliferative phase of soft tissue healing lasts approximately 3 to 6 weeks (Anderson, Parr, & Hall, 2009). The internal imagery intervention, which included multiple elements from the proliferative phase, was decided to be concluded after 2 weeks to encourage athletes to focus on the next stage of their recovery and resultant challenges that would be faced. The rationale behind this decision was to use healing imagery as a tactic to keep athletes directed towards the future and to prevent them from negatively dwelling on the physical challenges faced with suffering an athletic injury.

Results

Data was collected for each participant from the first week of injury until they returned to sport with a maximum 8 week recovery period permitted. Table 1 highlights this timeline. Results are discussed in three sections: description, evaluation of the differences between groups, and follow-up analysis of the imagery group.

Description

Participant information was collected for the intervention (n=6) and the control group (n=7) through the pre-study assessment. Table 2 displays participants' background information as well as information on their return to sport.

Injured athletes using the athletic therapy services at Wilfrid Laurier University were recruited as subjects. The majority of the participants in the study (n=10) were receiving treatment from an athletic therapist who handled athletes in soccer, volleyball, and baseball. Athletes competing in rugby and cheerleading (n=2) received treatment from another therapist at the clinic. The remaining participant (n=1) received treatment from a therapist that dealt specifically with the football team. Participants in the intervention group entered the study from 3 to 12 days following their injury (M= 6.33, SD= 3.01). Participants in the control group entered the control group from 1 to 20 days following their injury (M= 8.43, SD= 6.83). Table 3 highlights the elapsed time from the date of the injury until the first session with the researcher. The majority of participants (n=9) saw their recovery date or maximum time of recovery come in-season while their respective teams were still actively competing. The remaining participants (n=4) had their recovery time continue into the off season. Recovery dates for these participants, who all played for the men's and women's soccer teams, were determined primarily through attendance at mandatory off-season training and conditioning sessions and secondarily through

Table 1

Timeline of Participants Data Collection

Participant	Group	Weeks								Return to Play
		1	2	3	4	5	6	7	8	
1	Intervention	D	D	D	D	D				Yes
2	Intervention	D	D	D	D	D	D			Yes
3	Intervention	D	D	D	D	D	D			Yes
4	Intervention	D	D	D						Yes
5	Intervention	-	D	D	D	D	-	D		Yes
6	Intervention	D	D	D						Yes
7	Control	D	D	D	D	-	D	D	D	No
8	Control	D	D	D	D					Yes
9	Control	-	D	D	D	D	D	D	D	No
10	Control	D	D	D						Yes
11	Control	-	D	D	D	D	D	D	D	No
12	Control	D	D	D	D	D	D	-	D	No
13	Control	-	-	D	D	D	D	D	D	No

Note. D = data collected for week. - = missing data.

Table 2

Participant Information

Participant	Group	Injury	Injured Limb	Sex	Age	Sport	Playing Status	Prev. Serious Injury	Prev. Rehab. Experience	Prev. Imagery Use	Length of Recovery	Return to Play?
1	Inter.	Grade III ACL Sprain	Left	Female	20	Soccer	Starter	Yes	Yes	No	4.14	Yes
2	Inter.	Grade II ATF Sprain	Right	Male	22	Rugby	Limited	Yes	Yes	No	5.57	Yes
3	Inter.	Grade II ATF Sprain	Left	Male	20	Volleyball	Starter	No	No	No	5.57	Yes
4	Inter.	Grade II AC Sprain	Left	Male	21	Soccer	Starter	Yes	Yes	No	2.43	Yes
5	Inter.	Grade II MCL Sprain	Right	Male	21	Soccer	Starter	Yes	Yes	No	7.29	Yes
6	Inter.	Gr. II ATF & PTF Spr.	Left	Female	20	Volleyball	Starter	Yes	Yes	No	2.29	Yes
7	Control	Full Elbow Dislocation	Left	Male	20	Football	Starter	Yes	Yes	Yes	8.00*	No
8	Control	Grade II Hamstring Strain	Right	Male	19	Baseball	Starter	No	No	No	3.86	Yes
9	Control	Tibial Bone Bruise	Right	Male	21	Baseball	Often	Yes	Yes	No	8.00*	No
10	Control	Gr. II ATF Sprain	Left	Female	20	Soccer	Starter	Yes	Yes	No	2.14	Yes
11	Control	Fractured Talus Bone	Left	Female	19	Soccer	Starter	Yes	Yes	No	8.00*	No
12	Control	Grade II ATF Sprain	Right	Female	19	Cheerlead.	Starter	Yes	Yes	No	8.00*	No
13	Control	Grade II MCL Sprain	Right	Female	20	Soccer	Starter	Yes	Yes	Yes	8.00*	No

Note. * Eight weeks represents the maximum time of data collection rather than the participants' recovery time.

Table 3

Elapsed Time from Injury until Start of Data Collection

Participant	Group	Time from Injury until First Session (days)
1	Intervention	3
2	Intervention	6
3	Intervention	6
4	Intervention	5
5	Intervention	12
6	Intervention	6
7	Control	1
8	Control	3
9	Control	14
10	Control	5
11	Control	11
12	Control	5
13	Control	20

recreational activity levels (e.g. Weight-training, intramural sports). All participants who returned to activity levels out of season described that their coach expected them to return to their pre-injury activity levels as soon as they felt they were able.

Evaluation of the Differences between Groups

As previously mentioned, although all attempts were made to match participants to groups based on similar injuries, in order to gain participants for the study, athletes of varying injury severity were permitted to participate. Participants in the study were, therefore, dealing with injuries other than the proposed grade II ankle sprains. Participants with a pending diagnosis that were awaiting the results of a magnetic resonance imaging (MRI) test were also recruited into the study since it was essential that data was collected within the first week of the injury date. As a result, participants who were originally thought to have a grade II soft tissue injury were found to have a more significant injury. This meant that expected recovery for some injuries could be more than 8 weeks in length (e.g. fractured talus bone) while for others it would be significantly less (e.g. grade II acromioclavicular ligament sprain).

Because subjects returned to play at varying rates, significant subject mortality occurred over time- although for a good reason! Nevertheless, this presented a statistical issue for analyzing the key variables of satisfaction with rehabilitation and self-efficacy to recover over time. While acknowledging that survival analysis is the ideal statistical method to deal with significant differences in the data collection time periods, it was deemed beyond the scope of the current research project. Therefore, it was rationalized that capturing data for the first 3 weeks of injury management for all injuries would provide; (a) a method of comparing perceptions between groups independent of injury severity, (b) provide the required number of subjects to complete a statistical analysis, (c) evaluate changes in perceptions across time, and (d) utilized

only the participants who were evaluated within the first week of their injury. This method also proved beneficial on a second level as it worked to eliminate athletes dealing with more serious bone injuries (e.g. fractured talus bone, lateral tibial bone bruise). These athletes were originally thought to have grade II ligament injuries, however MRI results revealed further damage.

Based on the criteria of completing 3 consecutive time points, the number of participants included in the analysis was reduced to 9 [intervention group (n=5), control group (n=4)]. Table 4 highlights the description of the remaining participants. Statistics are presented for mean satisfaction with rehabilitation, mean self-efficacy to recover, and mean time of recovery for the 9 remaining participants (see Table 5). Note that the satisfaction with rehabilitation was first evaluated at the 2 week point in order to allow exposure to the rehabilitation program and gain a more accurate appraisal.

Satisfaction with Rehabilitation

The satisfaction with rehabilitation measurement was commenced in the second week of the study. A repeated measures ANOVA was conducted to analyze the two groups' satisfaction with rehabilitation over week 2 and 3 at the .05 significance level. The ANOVA revealed a significant interaction effect of group by time on satisfaction with rehabilitation, $F(1,7)= 5.86$, $p= .046$. Between week 2 and week 3, the intervention group became more satisfied with the rehabilitation program, while the control group became less satisfied. Table 5 demonstrates these changes in means. Figure 1 illustrates the interaction of group and time on satisfaction with rehabilitation. Thus, the hypothesis that participants in the intervention group would have a greater satisfaction with the rehabilitation process was supported.

Table 4

Participant Information for Participants with Complete Data in First 3 Weeks

Participant	Group	Injury	Injured Limb	Sex	Age	Sport	Playing Status	Prev. Serious Injury	Prev. Rehab. Experience	Prev. Imagery Use	Length of Recovery	Return to Play?
1	Inter.	Grade III ACL Sprain	Left	Female	20	Soccer	Starter	Yes	Yes	No	4.14	Yes
2	Inter.	Grade II ATF Sprain	Right	Male	22	Rugby	Limited	Yes	Yes	No	5.57	Yes
3	Inter.	Grade II ATF Sprain	Left	Male	20	Volleyball	Starter	No	No	No	5.57	Yes
4	Inter.	Grade II AC Sprain	Left	Male	21	Soccer	Starter	Yes	Yes	No	2.43	Yes
5	Inter.	Gr. II ATF & PTF Spr.	Left	Female	20	Volleyball	Starter	Yes	Yes	No	2.29	Yes
6	Control	Full Elbow Dislocation	Left	Male	20	Football	Starter	Yes	Yes	Yes	8.00*	No
7	Control	Grade II Hamstring Strain	Right	Male	19	Baseball	Starter	No	No	No	3.86	Yes
8	Control	Gr. II ATF Sprain	Left	Female	20	Soccer	Starter	Yes	Yes	No	2.14	Yes
9	Control	Grade II ATF Sprain	Right	Female	19	Cheerlead.	Starter	Yes	Yes	No	8.00*	No

Note. * Eight weeks represents the maximum time of data collection rather than the participants' recovery time.

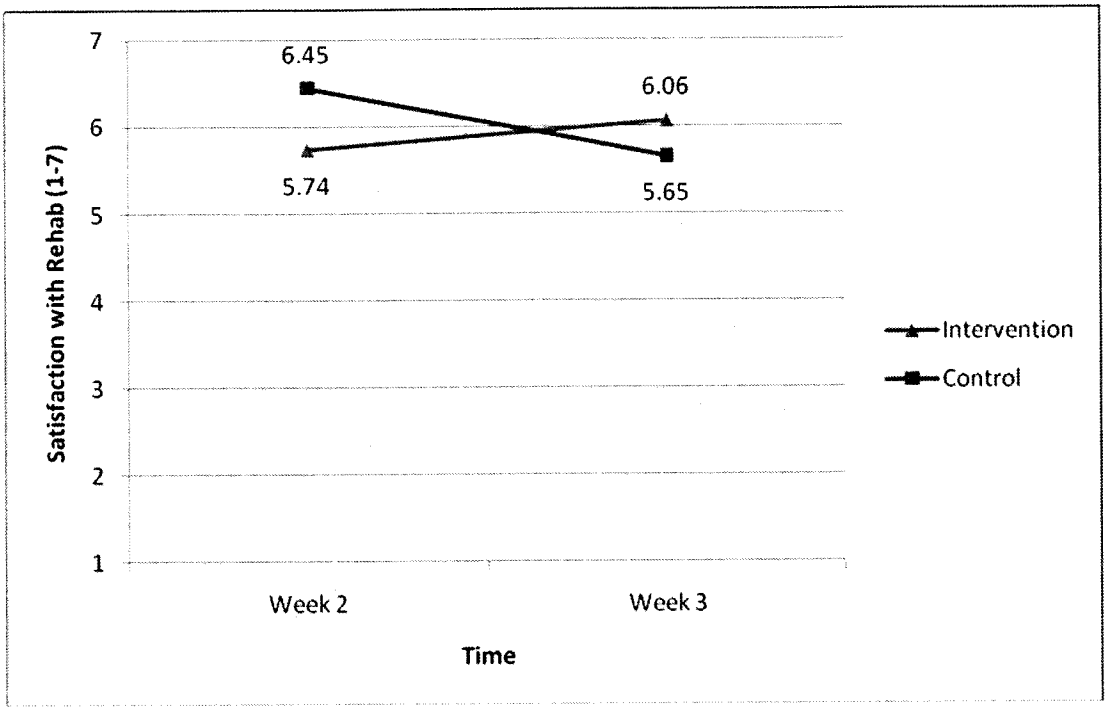
Table 5

Satisfaction with Rehabilitation, Self-Efficacy, and Recovery Time Over First 3 Weeks

Measure	Group	Week 1	Week 2	Week 3	Overall
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Satisfaction with Rehab (1-7)	Intervention	-	5.74 (1.15)	6.06 (0.88)	5.90 (0.97)
	Control	-	6.45 (0.34)	5.65 (0.91)	6.05 (0.58)
Self-Efficacy (0-100%)	Intervention	92.13 (6.22)	95.06 (6.06)	95.08 (9.37)	94.01 (6.37)
	Control	86.38 (11.38)	85.25 (13.82)	81.25 (15.76)	84.29 (11.51)
Recovery Time (weeks)	Intervention				4.00 (1.61)
	Control				5.50 (2.97)

Note. - = Data not applicable

Figure 1. Overall satisfaction with rehabilitation across week 2 and 3.



Self-Efficacy to Recover

A repeated measures ANOVA was preformed to compare the two groups in their overall self-efficacy ratings over the first 3 weeks of the study at the .05 significance level. The ANOVA revealed that there was not a significant interaction of group by time, $F(2,14)= 0.74$, $p>.05$. The AISEQ also contained subsections of three specific types of self-efficacy: task, barrier, and scheduling. To comply with the two-factor solution found by Milne et al. (2005), barrier and scheduling were combined to create the factor of coping self-efficacy. Contrary to Milne et al. (2005), all 10 items of the scale were included in the analysis to strengthen the amount of data available for data analysis. Two repeated measures ANOVA's were conducted to analyze task and coping self-efficacy for the intervention and control group across the first 3 weeks of recovery. All ANOVA's were performed at the .05 significance level. Mauchly's Test of Sphericity indicated that the assumption of sphericity was violated for task self-efficacy [$X(2)= 6.41$, $p=.040$]. Therefore, the degrees of freedom were altered using the Greenhouse-Geisser estimates of sphericity ($\varepsilon = .604$). The interaction of group by time on task self-efficacy was not found to be significant, $F(1.21,8.45)= 0.29$, $p>.05$. There was also no significant interaction of group by time found for coping self-efficacy, $F(2,14)= 1.04$, $p>.05$. A repeated measures ANOVA was also performed to discover if the participants in both the intervention and control group differed in their use of task and coping self-efficacy. The ANOVA revealed that the 9 study participants had significantly higher task self-efficacy levels ($M= 94.48$, $SE= 1.62$) than coping self-efficacy levels ($M= 87.06$, $SE= 3.88$) in the first 3 weeks of the study, $F(1,7)= 5.63$, $p=.049$. The hypothesis that the intervention group would display higher levels of self-efficacy than the control group was not supported.

Time of Recovery

Descriptive statistics for time of recovery were calculated for the intervention (n=5) and control group (n=4) (see Table 5). An independent samples t-test was conducted, at the .05 significance level, to determine if the two groups differed in time of recovery. Levene's Test for Equality of Variances revealed that the variances of the two groups were significantly different, $t(7)= 6.84$, $p= .035$ (at the .05 significance level). The groups were consequently analyzed with equal variances not assumed. The time of recovery for the intervention group ($M= 4.00$, $SD= 1.61$) was not found to be significantly different than the control group ($M= 5.50$, $SD= 2.97$), $t(4.39)= -0.91$, $p>.05$. Thus, the hypothesis that the intervention group would have a shorter time of recovery than the control group was not supported.

Strength and Flexibility Tests

Participants who returned to play before the maximum 8 weeks of rehabilitation were subject to strength and flexibility tests. All the athletes in the intervention group (n=5) returned to their pre-injury activity level before the maximum amount of time as compared to only two participants in the control group (n=4). Physical tests were performed within a week following their return. Four athletes in the intervention group conducted strength and flexibility tests upon return from their injury. One participant (grade III ACL sprain) was re-injured upon their return to sport. Of the four participants in the intervention group, each demonstrated a 90% level of flexibility in the most appropriate plane of motion in their injured limb compared to their healthy limb upon the first goniometer test by the athletic therapist. However, when strength testing was conducted on the Cybex dynamometer in the most appropriate plane of motion for the participants' injury, two of the four participants did not reach the desired level of 90% strength in the injured limb as opposed to the healthy limb. The two participants were found to have 90%

strength in their injured limb upon retesting the following week. The two participants in the control group both demonstrated 90% flexibility and strength in their injured limb during the first week of testing.

Imagery Use

The frequency that participants used cognitive, motivational, and healing imagery was calculated through the AIIQ-2. The scale had participants rank how often they used a specific function of imagery (see Appendix E). Descriptive statistics for the frequency of cognitive, motivational, healing, and total imagery use were calculated for the intervention (n=5) and control (n=4) group (see Table 6). Even though the control group did not receive the imagery intervention, it was possible that they could have been using imagery techniques on their own. Therefore, it was relevant to assess the control group's use of imagery.

Table 6

Frequency of Imagery Use for Intervention and Control Group

Group	Frequency of Cognitive Imagery Use (1-7)	Frequency of Motivational Imagery Use (1-7)	Frequency of Healing Imagery Use (1-7)	Total Frequency of Imagery Use (1-7)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Intervention (Final week)	5.75 (1.06)	6.07 (1.19)	5.45 (1.82)	5.73 (1.18)
Control (Final Week)	4.31 (0.65)	5.67 (0.67)	3.88 (1.93)	4.53 (0.72)

Frequency of imagery use was measured weekly for the intervention group where the control group was given the AIIQ-2 once at their respective completion of the study. To encourage the most accurate comparison of both groups imagery use, the AIIQ-2 measure from the intervention groups' last week in the study was used to match that of the control groups'. An independent samples t-test was conducted at the .05 significance level to determine if the two groups differed in their overall frequency of imagery use. The intervention group (M= 5.72, SD= 1.18) did not use significantly more overall imagery than the control group (M= 4.53, SD= 0.72), $t(7)= 1.77$, $p>.05$. A MANOVA was also performed at the .05 significance level to compare the frequency of use of the three different types of imagery. The intervention group (M= 5.75, SD= 1.06) was found to use significantly more cognitive imagery than the control group (M= 4.31, SD= 0.63), $F(1,7)= 5.67$, $p= .049$. The two groups did not differ in the frequency of motivational imagery use, $F(1,7)= 0.35$, $p>.05$. Most important, the two groups were found to not significantly differ in their frequency of healing imagery use, $F(1,7)= 1.58$, $p>.05$. The latter result indicates that the control group was using self-directed healing imagery often during their recovery from injury.

Follow-up Analysis of Imagery Intervention Group

Analysis of the imagery intervention group included all members of the intervention group (n=6). The entire intervention group was used to increase the sample size and, consequently, the amount of information available for data analysis.

Frequency of Imagery Sessions

Participants in the intervention group (n=6) were asked to conduct imagery a minimum of three times per week. The mean number of imagery sessions while in the program ranged from

2.33 to 4.67 per week. Including the intervention session with the researcher, the participants were found to meet this weekly quota (M= 3.04, SD= 0.83).

The AIIQ-2 measured participants in the intervention group's frequency of imagery use on a weekly basis, commencing in the second week of the study. This measure asks participants how often they use components of cognitive, motivational, and healing imagery on their own, independent of the number of actual structured imagery sessions. Participants reported a gradual rise in their frequency of imagery use over the course of the imagery intervention (see Table 7).

Imagery Ability

The ability of the intervention group (n=6) to conduct accurate imagery was assessed using six different sub-sections: vividness, controllability, visual imagery, kinaesthetic imagery, internal imagery, and external imagery. Similar to the AIIQ-2, the imagery ability check was first distributed in the second week of the intervention program. Participants reported a gradual increase over time in all subsections of imagery ability. Table 8 highlights the descriptive statistics of the intervention group's imagery ability.

Qualitative Follow-up of Intervention Group

Participants in the intervention group (n=6) were asked to complete a follow-up analysis of their experience with the imagery intervention after the conclusion of the data collection phase. Five participants were able to complete the written qualitative analysis that contained six questions pertaining to the athletes' experience with imagery and their personal opinion on the effect that imagery had on their recovery from injury (see Appendix G). The process of content analysis was used to analyze the text through coding and quantification of the participants' answers (Silverman & Marvasti, 2008). Subheadings were organized to match the questions that were asked. Content analysis was subsequently used to identify themes with the participants'

Table 7

Frequency of Imagery Use per Week for the Intervention Group

Type of Imagery	Mean Frequency of Imagery Use (1-7) [Mean (SD)]						
	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Cognitive	4.30 (1.61)	5.13 (1.59)	5.38 (1.20)	5.88 (0.85)	5.63 (1.94)	6.75 (-)	-
Motivational	3.67 (2.63)	5.72 (1.90)	6.00 (1.19)	5.92 (1.32)	6.17 (1.18)	7.00 (-)	-
Healing	4.85 (1.43)	5.75 (1.29)	5.56 (1.61)	5.50 (1.88)	6.50 (0.71)	7.00 (-)	-
Participants (n)	5	6	4	4	2	1	0

Note. - = Data not applicable

Table 8

Imagery Ability per Week for the Intervention Group

Imagery Subsection	Mean Imagery Ability (1-7) [Mean (SD)]						
	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Vividness	5.40 (1.19)	6.38 (0.67)	6.06 (0.72)	6.25 (0.50)	6.50 (0.71)	6.50 (-)	-
Controllability	5.50 (1.17)	6.17 (0.68)	6.25 (0.65)	6.13 (0.85)	6.50 (0.71)	6.00 (-)	-
Visual	5.80 (1.64)	6.17 (0.75)	6.00 (0.82)	6.00 (0.82)	6.50 (0.71)	7.00 (-)	-
Kinaesthetic	4.40 (1.67)	5.33 (1.86)	5.25 (1.71)	5.50 (1.73)	6.00 (1.41)	6.00 (-)	-
Internal	5.10 (1.52)	5.67 (1.03)	5.69 (1.25)	5.88 (0.85)	6.25 (1.06)	5.00 (-)	-
External	5.80 (1.10)	6.42 (0.80)	6.75 (0.50)	6.75 (0.50)	7.00 (0)	7.00 (-)	-
Participants (n)	5	6	4	4	2	1	0

Note. - = Data not applicable

answers. The data for participants who agreed to complete in the qualitative follow-up (n=5) is listed below.

The Effect of Imagery in Injury Rehabilitation. The qualitative response from the athletes in the intervention group revealed that the healing imagery intervention affected each participant in their own unique, multi-faceted way. Themes that emerged from the analysis linked the healing imagery intervention to: confidence, frustration, motivation, injury awareness, rehabilitation adherence, relaxation, and focus. The following themes are presented with direct quotes from the athletes used to support the observation of a theme.

When posed with the question of what the healing imagery intervention did for the injury rehabilitation, one participant maintained that the external imagery added to their confidence levels in their injured limb. The participant felt that the external script allowed them to increase their confidence in the physical strength of their ankle, positively affecting their recovery: "I do feel however that the 2nd script instilled confidence in the strength of my ankle which allowed me to return to sport quicker". They also felt that the external script was the more important of the two: "I found that the second imagery script helped me most with the confidence I had in my ankle. I believe the second script was most useful to me". The same participant also felt that the internal script was very useful in limiting the frustration associated with what was their first serious injury: "The first imagery script I used helped most with the frustration I felt from having to go through such a long rehabilitation process. It was reassuring for me to go through the script and imagine the tissue healing".

One participant stated that imagery made them more conscious of their injury, as well as their body as a whole. This participant felt that imagery made them more aware and in tune with their body through the recovery process:

> I felt that it made me very aware of my injury and allowed me to listen to my body's response to injury and to understand what my abilities were. Therefore, it allowed me to monitor my body and see if I needed to take it easy and not push myself as hard so early in my injury.

This same participant maintained that the increase they felt in their injury awareness contributed to a greater adherence to their rehabilitation program with athletic therapy:

> It definitely made me realize my injury more and thus commit to it more by going to rehab clinic every day and being aware of my body's signs and symptoms on when to lay off and when to push myself.

This participant also stated that the internal imagery intervention helped with their adherence to injury rehabilitation through increasing their levels of motivation and keeping their mindset positive: "I also think that thinking about all the fibres in my ankle heeling [*sic*] kept me more positive and gave me more motivation to do my exercises because I could visualize how the fibres would be piecing themselves back together". While another participant stated that imagery helped them control arousal which helped in their adherence to a scheduled recovery: "It helped me relax and make routine in my recovery". Similarly, another participant revealed that they believed healing imagery helped them to relax: "[It] allowed for relaxation and helped cope with the stresses of obtaining an injury". This athlete also suggested that imagery helped them maintain a positive affect: "[It]... helped me be positive about the recovery process".

One participant believed that healing imagery encouraged them to put more focus and concentration towards their injury, which led to an increase in injury awareness and rehabilitation adherence: "Imagery helped me to focus my energy on my knee. I used it to ensure

that my knee was always on my mind, therefore ensuring that I rested it or did the necessary exercises to help it heal".

Overall, all the participants who completed the follow-up assessment stated that imagery contributed positively in some manner towards their injury recovery. One participant stated that they believe the healing imagery intervention helped them arrive to their current level of health: "I have stayed injury free other than slight throbbing here and there after physical activity... I feel like heeling [*sic*] imagery helped me to get to this stage". The same participant expressed that they would use internal healing imagery again in the future if they were to experience another serious soft tissue injury:

> I like the idea of using heeling [*sic*] imagery when there are actual fibres torn because I find that easier to picture heeling [*sic*]. Therefore, if I were to tear something again, even if slightly I would definitely use heeling [*sic*] imagery I just find it hard to use without tears.

Another participant stated that, regardless of the quantitative measures of the study, they believed that the imagery intervention aided in their recovery: "I'm not exactly sure how imagery can quantitatively be examined in speeding up the healing process, but I feel that it helped". Finally, the participant who was reinjured upon their return to sport, interestingly, made the observation that imagery was more helpful for short-term injuries rather than more serious, long-term injuries: "I think it helped at the beginning of the injury because it was the last bit of hope of recovering without surgery but I think soon as I found out I needed surgery it wasn't as effective".

Imagery Ability over Time. Similar to the quantitative data, participants stated that their imagery ability improved throughout the study. One participant believed that their imagery

ability improved as they became more relaxed. They also alluded that their vividness and controllability increased as the study progressed: "I got better at relaxing and thinking about what I was imagining in a clearer picture. I [was] able to think about what I needed to faster". Another participant similarly maintained that they felt their vividness and controllability increased after each session: "Each time I practiced using imagery I became better and the image became clearer and more detailed than the time before". Two participants explained that the Injury Education Program helped a great deal to increase the vividness of their injury. When asked if their imagery ability improved over time, one participant explained:

> Yes. With more and more practise I believe I was. It also helped when Joel explained what the knee looks like or what the injury has done to my body. This gave me a better picture in my mind when using imagery.

The other participant referred to the review of the still images and the anatomical computer program in the Injury Education Program as helping to aid in the vividness of their imagery:

> I think that it was helpful to see the video of people who sprain their ankles before hand and what it looks like when the fibres come together because then I had a better idea of what was going on in my own ankle and could use those images in my mind.

Another participant explained that they had trouble with the vividness of the imagery at the beginning of the study, but felt that it increased over time as they were able to personalize the images in their head:

> Yes I definately [*sic*] improved my ability to imagine the internal as well as the external imagery after going through this study. The first couple times (even after being explained what tendons and tissues looked like) I had difficulty imagining

> the exact processes that took place. I think that once I had found a way to picture the processes involved it became easier because I would return to this same constructed imagery in subsiquent [*sic*] 'imaginings'. This is the same for the external imagery, I had my regular images that I would bring up again and again.

Self-Directed Imagery versus Imagery with the Researcher. When questioned about the use of imagery led by the researcher in the intervention sessions and how it differed from their self-directed imagery that they were asked to conduct on their own, the participants offered differing opinions on which imagery session they preferred. One participant found that the session with the researcher was more effective as it was easier to follow the progression of the items on the imagery script:

> I think having someone read it to you was more effective because you could keep your eyes closed the whole time. The transition between steps was better when someone was reading it because you didn't have to open your eyes and read the next line.

Another participant preferred the imagery with the researcher because they felt it increased their focus: "Imagery conducted by the researcher was much more effective as I was able to completely focus on picturing the muscle healing".

On the contrary, one participant believed that the self-directed images were better over time because they were able to progress at their own pace through the session:

> It wasn't as affective [*sic*] at the start because the script was unfamiliar and I had to stop and open my eyes to read the script. However I think that once I knew the script better I found just as good if not better then the imagery with the researcher.

> I found it better at times because if I was having difficulty with imagining a particular image I could take my time in picturing it before moving on.

The remaining two participants described their imagery in both settings as very similar. One participant thought that it was not difficult to recall the items from the script on his own:

> There wasn't too much difference besides the fact I had to remember what I was doing, whereas in the sessions Joel would read it to me. In both settings I tried to be really relaxed in order to focus precisely on my knee.

The other participant described that their previous education at university aided in their ability to create detailed, vivid imagery on their own:

> It was similar when I conducted it on my own just because I had learnt about the heeling [*sic*] process so much through kinesiology and having it explained and read to me for the first time by the researcher helped me become very good at it almost right from the start.

Current Use of Imagery. Participants were questioned about their use of imagery for previous or current injuries. Of the five participants who provided feedback information, only one participant stated that they used an indirect form of healing imagery for their past injury:

> I find myself noticing the physiological aspects of my body more and imagining what the fibres look [like] when I feel aching but I have not been using the imagery for heeling [*sic*] because I feel my injury has heeled it just throbs every so often as a tendonitis would feel like.

The remaining four athletes stated that they no longer used any form of healing imagery for their previous injury. When asked if they used imagery currently for their sport, it was revealed that the athletes do often use imagery for performance benefits. One participant generally referred to

using imagery for mental practice in completing tasks: "I use imagery a little when thinking about a task that hasn't been done in awhile or before. I think about what I need to do to complete the task and picture myself doing the task". This statement from the participant alludes to the cognitive role imagery plays. One participant clearly indicated that they use both cognitive specific and general imagery to practice set skills and complex plays in their head:

> During soccer games/practises I always try to envision what and how a play will play. I try to picture exactly what I'm going to do once I get the ball; how I'm going to shoot it, pass it or dribble it. This helps me for when I actually do get the ball, I already have an idea of what to do with it.

Lastly, one athlete described that the imagery intervention opened his mind for the possibilities of imagery for performance benefits in sport. Upon completion of the intervention, this participant asked the researcher for recommended further readings for imagery and sport psychology, in general. The participant implied that they began to use a combination of motivational general-arousal imagery and positive self-talk to prepare for competition. The participant described their current routine during competition:

> However I do still use imagery to prepare for sport, which is something that I never did before. I found the best technique is affirmations (right name?); beforehand I pick out two or three things that make me nervous or that I'm worried about in the upcoming game. I relax for approx 20 minutes and go through a process where I address these concerns and tell myself that I can easily overcome these demands. I find its [*sic*] been very helpful and I've realised [*sic*] a much more consistent performance which I believe is tied to the imagery.

Injury Status Following the Study. Finally, athletes were questioned about their current injury status in relation to their sport. Three participants from the imagery group remained injury free following the study. One athlete was reinjured within days of their return to sport and required surgery to fix their damaged ligament. The remaining athlete injured their knee 2 months after the study was completed.

Discussion

The purpose of the current study was to evaluate the effectiveness of a healing imagery intervention on injured varsity athletes. It was hypothesized that participants in the intervention group would experience more satisfaction with their injury rehabilitation experience, would be more self-efficacious in their recovery from injury, and would have a shorter time of recovery than the control group. A qualitative review was used after the completion of the study to capture more detail regarding the effectiveness of the imagery intervention during recovery from injury. The results of the previous analysis are discussed in detail below.

The results revealed that in the first 3 weeks of the study, a significant interaction effect was found for overall satisfaction over time for the two groups. The intervention group experienced an increase in their satisfaction with rehabilitation from week 2 to week 3, while the control group experienced a decrease in satisfaction from week 2 to week 3. This finding suggests that using imagery may increase overall satisfaction with the recovery process. However, one must be careful with this conclusion, as the groups were different in satisfaction level to begin with. The control group began rehabilitation less satisfied than the intervention group. A true interaction effect occurred where over time the control group experienced a decrease in satisfaction while the intervention group experienced an increase. A main effect for group alone was not found, therefore, we cannot attribute the change to group (i.e. imagery).

These findings are similar to Law et al. (2006) who found that those who used imagery for pain management displayed a greater level of satisfaction with the rehabilitation experience. They are also similar to the findings of Ievleva and Orlick (1991) as the authors discovered that fast healers, who used more healing imagery, had more positive associations with their rehabilitation experience.

Participants in the intervention group perhaps felt that they were making more progress and advancement in their recovery during this time period, resulting in a greater satisfaction with their rehabilitation. Recall that the imagery intervention shifted from an internal focus to an external focus in the third week of the study. The external imagery intervention was aimed towards being healthy and fully functioning. This may have provided the intervention group with a future goal and clear vision regarding rehab completion, thereby increasing their perceived levels of satisfaction.

Conversely, however, the control group experienced a decrease in their satisfaction from the second to third week of their recovery. The root of this displeasure could be attributed to the athletes' perceived lack of advancement with their recovery. Without the intervention to provide direction and vision, these athletes could easily feel frustrated with their rehabilitation progression. It is possible that the control group initially (during week 2) ranked their satisfaction high due to the increased social support they may have felt from assistance from the athletic therapist and weekly meetings with the researcher who displayed care for their progress and well-being. As the protocol of the meetings with the researcher did not change over the first 3 weeks, athletes may have felt this support fade as there was little constructive benefit offered from the weekly meetings with the researcher as the study progressed.

The intervention group did not display significantly higher levels of self-efficacy across the first 3 weeks of the study than the control group. However, although not significant, descriptive analysis indicated that the intervention group was more self-efficacious than the control group. The intervention group consistently ranked their self-efficacy levels as high, showing a rise from the first to second week specifically. The control group decreased in their levels of self-efficacy levels, particularly from the second to third weeks. Sordoni et al. (2002)

found that healing imagery was the only type of imagery that was positively related to self-efficacy. Similarly, Ievleva and Orlick (1991) reported through a qualitative analysis that athletes in the fast healing group reported a greater feeling of control over the healing process than athletes in the slow healing group. Although a significant interaction was not found, the descriptive statistics provide promise that a healing imagery intervention may indeed increase athletes' self-efficacy to recover, aligning with the previous findings of Sordoni et al. (2002) and Ievleva and Orlick (1991). Had the sample size of both groups been larger, the differences between the two groups in self-efficacy levels may have proved to be significant.

Milne et al. (2005) found that the AISEQ could effectively be divided into two measures of self-efficacy; task and coping efficacy, and that participants used more task than coping efficacy during their injury rehabilitation. The current study supported these findings as participants in both groups were found to use significantly more task than coping efficacy. These findings indicate that, athletes in the current study, independent of group, have high confidence in their abilities to physically complete the rehabilitation exercises as outlined by their athletic therapist (the task component). However, athletes' confidence in their abilities decreased considerably when faced with adversity during the rehabilitation program. Coping efficacy evaluated an individuals' perceived ability to overcome physical, emotional, and organizational challenges that are associated in returning to health after an injury. These findings signify that athletes may be comfortable with task related challenges faced with rehabilitation but may need more support and guidance in dealing with unforeseen problems that may inevitably arise when faced with a long rehabilitation process.

The intervention and control group also did not significantly differ with respect to recovery time. The descriptive statistics indicated that the intervention group had a shorter

recovery time than the control group. However, the independent t-test revealed that the difference between the groups was not significant. The variances between the groups were significantly different. Evaluating the descriptive statistics in closer detail, the variance of the control group was considerably larger than the intervention group. This indicates that there was a wide range in the time of recovery for participants within the control group. The healing imagery intervention may reduce the variability within recovery time meaning that recovery time for all injuries is reduced. However, a study with a larger sample size is needed to evaluate this suggestion.

Recovery time was an ambitious variable to calculate as it aimed to quantify the healing time through self-report, as well as through physical means of strength and flexibility. The combination of these measures was devised to attempt to gauge if participants were both mentally and physically prepared to return to sport. It was also an improvement to previous research. In order to accurately compare the two groups on this factor, it was important that both groups were dealing with similar injuries. Recall, it was the researcher's original intent to assign participants to groups to groups matched by similar injuries. However, without the use of a sample with exactly similar injuries or a method of participant matching, the recovery time variable may be compromised due to the potential threat to internal validity of injury severity. Nonetheless, although subjects were not matched on injury type, injury severity between groups was similar enough that an evaluation of imagery effects on recovery time could be examined, keeping in mind the limitations due to injury recovery time differences.

In relation to the strength tests that were coupled with the athletes' return to activity, the data collected from both groups suggested that athletes in the intervention group may have been pushing themselves to return earlier in the injury process. The desired level of 90% strength in

the injured limb compared to the healthy limb was not achieved by two out the four participants tested in the intervention group within a week of their return. The two participants tested in the control group achieved 90% strength on the first attempt. These results indicate that the athletes in the intervention group may have been mentally prepared to return to sport, but not as physically prepared as they should be for a healthy return to sport. However, there is a limited amount of data upon which to draw these conclusions. Further studies investigating time of recovery should examine strength as a measurement to explore if athletes who are involved in an imagery intervention are more likely to push themselves to return to sport when their injured limb may still display considerable weakness.

Interestingly, results revealed that the intervention group did not use significantly more healing imagery than the control group. Again descriptive statistics suggest that the intervention groups' use of healing imagery was higher, while a statistical analysis found that these differences were not significant. These results suggest that athletes in the control group were using a form of healing imagery on their own. Perhaps the use was not as focused or directed as the intervention groups, but the response to the healing imagery items on the AIIQ-2 implied that the control group was naturally forming images of healing during their recovery. It is possible that the athletes in the control group were using the education of their injury learned from the athletic therapist to fuel their own self-directed healing imagery. It is also possible that the reading of the cue from the AIIQ-2 could have sparked the athletes in the control group to retrospectively link thoughts of healing they may have had at some point in their recovery and cause them to portray that they used that function of imagery more frequently than they actually did. The suggestion by Short et al. (2004) for the AIIQ-2 to include athletes' perceptions of the purpose of their images could aid in combating this issue.

The researcher was expecting to see higher levels of healing imagery use from the intervention group and lower amounts of use from the control group. However, because imagery use was evaluated only at the end of the program for the control group, in order to compare the groups, the researcher had to use only the last time point for the intervention group. This may not have been the most realistic assessment for the intervention group. They may have used imagery more frequently in the early weeks of recovery when they were highly motivated to return to their sport. Because these athletes returned to their sport in their last week of recovery, healing imagery may not have been as big a priority. In studies evaluating other mental skills such as goal setting, relaxation techniques, etc., control group participants often cite spontaneous use of the technique as well. An interesting future direction is to qualitatively examine the use of healing imagery in the control group to better understand this process.

The intervention group did not use more motivational imagery than the control group, but they did however use significantly more cognitive imagery. Cognitive imagery can be used in injury recovery to image rehabilitation exercises as well as image sport specific images, such as a simple skill like shooting a soccer ball or a team play like a planned attack in volleyball. The external imagery script was designed to incorporate aspects of imaging simple movements of everyday life. This was successful at improving the use of cognitive imagery for the intervention group. Athletes in the intervention group increased in their cognitive imagery use from week 2 to 3, when the intervention was shifted from internal to external imagery. The external imagery intervention appeared to result in a difference in cognitive imagery use. The intervention group used it more often than the control group during recovery.

Nevertheless, motivational imagery was still ranked most frequently for use by both groups during their rehabilitation. This is consistent with a number of other studies where

athletes reported that motivational imagery was used most often in injury rehab (Driediger et al., 2006; Law et al., 2006; Milne et al., 2005; Sordoni et al., 2002). These results are especially interesting for the intervention group since they received an imagery intervention that was strictly based around healing imagery. Milne et al. (2005) suggested that athletes use less healing imagery because they are unsure of what to image. The results from the present study indicate that a lack of knowledge on what to image may not have been the reason as to why healing imagery was used less often. Athletes may use healing imagery less often because it is abstract, unfamiliar, and there is little way to determine if it is indeed making a difference in their physical recovery. Cognitive and motivational imagery are related to challenges and scenarios that athletes may commonly experience during injury recovery. Because athletes are more familiar with these scenarios and already have a vivid image of them in their head, they would be more likely to conduct related imageries. Motivational imagery may be the most pertinent to injury recovery because athletes are away from their sport and limited in their activity. These associated stresses could be a major focus of their recovery and would call for imagery use to help them get through the tough periods and back into sport.

The qualitative review of the intervention group revealed some very important, specific effects that the healing imagery intervention had on the participants. An advantage of the qualitative follow-up was the depth of information captured from each athlete. Individual thoughts are often difficult to capture with quantitative methods. The most information rich items surrounded the two questions that asked athletes to describe the effect that imagery had on the recovery and if they believed it helped their recovery in any manner. The five participants maintained that imagery helped them increase confidence, motivation, injury awareness, rehab adherence, relaxation, and focus and decrease frustration. One athlete stated that imagery

especially helped to increase confidence and decrease frustration. This athlete believed that imagery helped increase their confidence in the strength of their injured limb. This could be linked to an increase in self-efficacy to recover as the athlete builds faith their physical abilities improving. While the quantitative analysis did not reflect the importance of self-efficacy, the qualitative analysis clearly captures the importance of perceptions of control and confidence in the rehabilitation process.

Two important themes that emerged were that the imagery intervention helped athletes (a) increase injury awareness and (b) improve rehabilitation adherence. Injury awareness increased through healing imagery and the Injury Education Program. Increased awareness is beneficial in injury rehab as the athlete can become more integrated and involved in the process. Increased awareness can combat the separation that some individuals may feel during injury recovery due to a lack of knowledge of the process. This increased awareness could contribute to greater enthusiasm and passion for rehabilitation, thereby, helping an athlete return to sport earlier. Increased rehab adherence may result from an increase in injury awareness, as several athletes felt that the intervention helped in committing to a regular program needed to physically overcome their injury.

Overall, athletes in the intervention group felt that the healing imagery intervention was positive to their recovery. The qualitative results suggest that, although a healing imagery intervention may be difficult to quantitatively evaluate, the recovery benefits may be vast. Interventions that are adaptable and individualized with respect to healing, cognitive, and motivational imagery appear to be helpful for injury recovery.

The qualitative results also presented valuable information about the intervention groups' imagery practices. All five participants stated that their ability to conduct imagery improved over

time, supporting the descriptive statistics that displayed a gradual increase over time. The participants especially felt that the vividness of imageries increased over time as they became more adjusted to the practice of using imagery. When asked if they preferred imagery with the researcher or imagery on their own, the participants offered mixed opinions. These mixed results indicate that imagery is a very personal practice. In order for imagery be successful, an athlete must individualize their images and ensure that the imagery material is constructive for them.

Evaluating the function of imagery using qualitative research methods provided a greater level of understanding of the phenomenon than using quantitative methods alone. Quantitative measures do not have the capability to evaluate the individualized effect that imagery has on an individual. Qualitative methods provide an avenue for athletes to specifically describe their unique experience with imagery. The unrestricted boundaries of qualitative methods aid in discovering the true function of imagery for the individual. Future studies should employ qualitative methods in order to reveal the individualized effect that imagery has for athletes.

A strength of the present study was the attempt to quantify and examine imagery use in a controlled empirical design. The methodology was ambitious in nature as it was an ecological clinical trial that aimed to utilize a true experimental research design in order to evaluate the effectiveness of imagery in the rehabilitation process. This study was also unique as it made an attempt to quantify the variable of time of recovery which has been absent in previous athletic injury rehabilitation literature examining imagery use.

However, the study was also faced with significant challenges. One limitation of the study was the small sample size of both groups. The low number of participants could have affected the power of the statistical testing as low power can increase the likelihood of committing a type II error. The low number of participants conversely did not allow the

researcher to use participants with similar injuries or allow for the exclusion of participants who had previous imagery use and previous rehabilitation experience. A strength of previous studies of imagery in injury rehabilitation was the use of athletes with similar injuries (Christakou & Zervas, 2007; Christakou et al., 2007, Cupal & Brewer, 2001, Ievleva & Orlick, 1991). These studies were able to control for psychological and emotional changes that are associated with injury severity (Evans et al., 2006). Controlling for these changes would have increased the internal validity of the present study.

A second limitation of the study was that, in retrospect, two more measures should have been included in the evaluation. First, participants' motivation to return should have been measured. Those more motivated to return could have had a shorter time of recovery. Second, a measurement of pain management and injury prevention imagery, as identified by Driediger et al. (2006), was not included in the study. The authors of the article suggested that the AIIQ-2 needs to add sections for pain management and injury prevention imagery as well as add more injury specific questions to improve the accuracy of the measure (Driediger et al., 2006). Others also maintain that the perceptions of imagery should be included to unveil the true purpose of the image (Evans et al., 2006; Short et al., 2004). These two types of imagery should be measured to gather a better understanding of how athletes' use imagery in injury recovery.

Future research evaluating imagery use in athletic injury rehabilitation process should aim to increase the knowledge on the experience of a research participant exposed to a healing imagery intervention. Through the increased use of qualitative methods, the multi-faceted, clinical benefits gained from healing imagery will be better revealed. Future studies should also work to improve the time of recovery variable combining athlete self-report with strength and flexibility testing with an increased sample size of athletes with similar injuries.

Imagery is a powerful clinical skill that could be beneficial for healthcare professionals to utilize. Previous research, however, found that healthcare professionals viewed imagery and relaxation as the mental skill least likely to help athletes cope with their injuries (Francis et al., 2000) and that imagery for healing purposes is the least effective type of imagery (Hamson-Utley et al., 2008). Clearly, professionals within the rehabilitation process need to be made aware of and convinced of the potential that imagery holds in aiding the rehabilitation process. The mandate now is to disseminate this imperative to those professionals working first hand with athletes.

Overall Conclusion

The current study contributed to our understanding of imagery use in the following ways. First, it was found that a healing imagery intervention may influence an injured athletes' satisfaction with rehabilitation over the first 3 weeks of recovery. Participants in the imagery group began the rehabilitation process more satisfied than the control group and became more satisfied over time while the control group became less satisfied. Second, injured athletes are typically high in task self-efficacy, demonstrating that they have a high belief in their ability to accomplish prescribed duties during injury recovery. Third, coping efficacy of the injured athletes was relatively low, suggesting that injured athletes may need more support and techniques for overcoming difficult and stressful situations. However, the intervention group was found to use a significantly greater amount of cognitive imagery. This suggests that an imagery intervention of any kind can diversify athletes' use of imagery for other functions. Fourth, the qualitative results revealed that healing imagery is a mental skill that is very personal and will uniquely affect each individual. Fifth, the mental skill of healing imagery is teachable and can be effectively instilled in athletes who have no prior experience with imagery. As a result, healing

imagery is a mental skill that should be accepted as a part of the injury rehabilitation model. Healthcare professionals should be taught the technique in their respective education programs so they can confidently recommend the mental skill for use among their patients. Another method to encourage athletes to use imagery would be to have a licensed psychologist in clinic to teach the effective use of the mental skill. Overall, imagery is a skill that should be utilized to provide the individual with an opportunity to make injury rehabilitation a more positive, constructive experience.

Appendix A

Pre-Study Assessment

PRE-STUDY ASSESSMENT FORM

Name: _____

I Background Information:

Sex: ___M ___ F

Age: ____

II Sport History:

What varsity sport do you currently compete in? _____

Please answer the following about your involvement with the team:

___ I play a limited amount of time (0-2 games season)

___ I play occasionally (once every 3+ games)

___ I play often (every 1-2 games)

___ I am a starter/everyday player (every game)

III Current Injury:

1. What type of injury did you sustain during sport? Was it given an official label from the athletic therapist (e.g. grade II ankle sprain, grade I muscle strain)? Briefly describe:

_____

_____

---

2. What was the projected time of recovery given to you by the athletic therapist? Please indicate which length of time the therapist predicted for a full recovery:

___ 0-2 weeks

___ 2-4 weeks

___ 4-6 weeks

___ Over 6 weeks

3. How has your injury affected your activity level? Please indicate the activity level that is most appropriate:

___ Unable to be active

___ Able to do light activity (e.g. walking, light jogging) that is not sport related

___ Able to participate in team practice with limitation

___ Able to participate in team practice with little limitation

___ Able to practice at full intensity/ unaffected by injury

IV Injury History:

1. Have you had any previous serious athletic injuries?

___ yes ___ no

If **yes**, how many previous injuries have you had? Briefly describe them:

_____

_____

_____

2. Have you ever been involved in an athletic therapy or physiotherapy program as a result of any type of injury?

___ yes ___ no

If **yes**, briefly describe:

_____

_____

If **yes**, please indicate all types of the following therapies that you used during your recovery from injury:

___ Ice

___ Heat

___ Massage

___ Imagery techniques

___ Rehabilitation exercises

___ Brace/Taping

Appendix B

Daily Sport Activity Journals (DSAJ)

Figure B1. Daily sport activity journal for control group.

DAILY SPORT ACTIVITY JOURNAL

NAME: _____

Please place this Sport Activity Journal in a highly visible place (e.g., refrigerator door) where you will remember to complete it each day. Please complete this booklet for 6 weeks of the study.

Date	Describe your sport related activity. Was it easy? Hard? Painful?	Duration (minutes of activity)	Intensity (1-9: 1 being light intensity to 9 being heavy intensity)	Pain (1-9: 1 being no pain to 9 being extreme pain)
Sunday August 30	Description:_____ _____ _____	_____	_____	_____
Monday August 31	Description:_____ _____ _____	_____	_____	_____
Tuesday Sept. 1	Description:_____ _____ _____	_____	_____	_____
Wednesday Sept. 2	Description:_____			

	_____ _____	_____	_____	_____
Thursday Sept. 3	Description:_____ _____ _____	_____	_____	_____
Friday Sept. 4	Description:_____ _____ _____	_____	_____	_____
Saturday Sept. 5	Description:_____ _____ _____	_____	_____	_____

Was your sport activity level affected by any injury factors this week? Yes ____ No ____

If Yes, how?

Did you use any form of therapy, medication, ice, rest, etc. to help with your injury this week?

If Yes, how?

Figure B2. Daily sport activity journal for intervention group.

DAILY SPORT ACTIVITY JOURNAL

NAME: _____

Please place this Sport Activity Journal in a highly visible place (e.g., refrigerator door) where you will remember to complete it each day. Please complete this booklet for 6 weeks of the study.

Date	Describe your sport related activity. Was it easy? Hard? Painful?	Duration (minutes of activity)	Intensity (1-9: 1 being light intensity to 9 being heavy intensity)	Pain (1-9: 1 being no pain to 9 being extreme pain)	Imagery (Yes or No? Length of time?)
Sunday August 30	Description:_____ _____ _____	_____	_____	_____	_____
Monday August 31	Description:_____ _____ _____	_____	_____	_____	_____
Tuesday Sept. 1	Description:_____ _____ _____	_____	_____	_____	_____
Wednesday	Description:_____				

Sept. 2	_____ _____	_____	_____	_____	_____
Thursday Sept. 3	Description:_____ _____ _____	_____	_____	_____	_____
Friday Sept. 4	Description:_____ _____ _____	_____	_____	_____	_____
Saturday Sept. 5	Description:_____ _____ _____	_____	_____	_____	_____

Was your sport activity level affected by any injury factors this week? Yes ____ No ____

If Yes, how?

Did you use any form of therapy, medication, ice, rest, etc. to help with your injury this week?

If Yes, how?

Appendix C

Overall Satisfaction with Rehabilitation Scale (OSWRS)

Overall Satisfaction with Rehabilitation Scale

Rate your rehabilitation experience on the scale of:

1……..2……..3……..4……..5……..6……..7

Strongly disagree No opinion Strongly agree

Item	Satisfaction Rating- 1 (Strongly disagree) to 7 (Strongly agree)
I feel my progress through rehabilitation has gone well	
I am satisfied with the length of time the recovery process is taking	
I am enthusiastic to attend therapy sessions	
I have felt positive about the rehabilitation process	
Overall, I am satisfied with the rehabilitation process	

Appendix D

Athletic Injury Self-Efficacy Questionnaire (AISEQ; Milne et al., 2005)

Athletic Injury Self-Efficacy Questionnaire (AISEQ; Milne et al., 2005).

Rate your confidence on a scale from 0% (no confidence) to 100% (complete confidence):

Item	Self-Efficacy Rating- 0% (no confidence) to 100% (complete confidence)
I am confident that I can perform all the required rehabilitation exercises	
I am confident that I can follow directions from my physiotherapist	
I am confident that I can remember all my rehabilitation exercises	
I am confident that I can do my rehabilitation exercises when I am tired	
I am confident that I can do my rehabilitation exercises when I am in a bad mood	
I am confident that I can do my rehabilitation exercises when I feel I do not have the time	
I am confident that I can do my rehabilitation exercises even though I am feeling some discomfort	
I am confident that I can do my rehabilitation exercises regularly no matter what	

I am confident that I can follow the rehabilitation schedule outlined by my physiotherapist	
I am confident that I can overcome any obstacles that may hinder me from regularly doing my rehabilitation exercises	

Appendix E

Athletic Injury Imagery Questionnare-2 Part B (AIIQ-2; Sordoni et al., 2002)

Athletic Injury Imagery Questionnare-2 Part B (Sordoni et al., 2002)

Rate the frequency to which you do the following on the scale of:

1……..2……..3……..4……..5……..6……..7

Never Frequent

Item	Imagery Rating- 1 (Never) to 7 (Frequent)
I imagine myself working successfully through tough situations (e.g., slower than expected recovery, further injury, etc.)	
I imagine coping with the stress associated with my injury	
I imagine handling the anxiety resulting from my injury	
Prior to performing a rehabilitation exercise, I am able to imagine myself completing it perfectly	
I imagine each rehabilitation exercise	
I am able to change the image of a particular rehabilitation skill or exercise if necessary	
I am able to imagine new rehabilitation plans and strategies in my head if they were prescribed to me	

I imagine my damaged tissue returning to normal	
I imagine my body repairing itself	
I imagine the physiological changes my body is making during recovery (e.g., muscle or bone repairing)	
I imagine my body undergoing the healing process	

Appendix F

Imagery Ability Check (IAC)

Imagery Ability Check

Rate the following items regarding your imagery ability on the scale of:

1……..2……..3……..4……..5……..6……..7

Not at all Somewhat Extremely well

Item	Imagery Rating- 1 (not at all) to 7 (extremely well)
I am able to clearly create the images that are outlined on the script	
I am able to vividly produce images that are similar to reality	
I am able to image exactly what I am supposed to image	
I am able to control the images that I create to benefit the healing process	
I am able to create a clear visual representation of the injury	
I am able to feel the injury healing while I am applying imagery	
I am able to image the injury healing internally (e.g., the tissue coming together as a strong band)	
I am to image the physiological processes accompanied with the injury healing (e.g., increased blood flow to the injured area)	

I am able to picture myself as healthy and fully mobile	

Appendix G

Qualitative Imagery Follow-up Questionnaire

FOLLOW-UP QUESTIONNAIRE

1. What effect did healing imagery have in your recovery from injury while in the study?

2. Are you still using imagery for your former injury? Do you currently use imagery for sport? Please explain.

3. Did imagery help with your injury rehabilitation? Please explain.

4. Did you become a better imager over time? Please explain.

5. The researcher asked you to take the imagery script home and conduct imagery on your own. How did your self-directed imagery compare to the imagery conducted in sessions with the researcher?

Appendix H

Schedule for Control Group

Week	Description
1	Informed consent form, pre-study assessment, AISEQ
2	AISEQ, OSWRS
3	Same as week 2 (AIIQ-2 on week of return)
4	Same as week 2
5	Same as week 2
6	Same as week 2
7	Same as week 2
8	Same as week 2

Appendix I

Schedule for Intervention Group

Week	Description
1	Informed consent form, pre-study assessment, education of injury, internal imagery intervention, AISEQ, distribute journals
2	Internal imagery intervention, AISEQ, AIIQ-2, IAC, OSWRS
3	External imagery intervention, AISEQ, AIIQ-2, IAC, OSWRS
4	Same as week 3
5	Same as week 3
6	Same as week 3
7	Same as week 3
8	Same as week 3

Appendix J

Injury Education Program

Table J1.

Characteristics of Ligament Sprains (Anderson, Parr, & Hall, 2009)

	1st Degree	2nd Degree	3rd Degree
Damage to ligament	Few fibres are torn	Nearly half of fibres torn	All ligament fibres are torn
Distraction with stress tests	<5 mm distraction	5-10 mm distraction	>10 mm distraction
Weakness	Mild	Mild to moderate	Mild to moderate
Muscle Spasm	None	None to minor	None to minor
Loss of function	Mild	Moderate to severe	Severe (instability)
Swelling	Mild	Moderate	Moderate to severe
Pain on contraction	None	None	None
Pain with stretching	Yes	Yes	No
Range of motion	Decreased	Decreased	May increase or decrease

Table J2.

Characteristics of Muscle Strains (Anderson, Parr, & Hall, 2009)

	1st Degree	2nd Degree	3rd Degree
Damage to muscle	Few fibres are torn	Nearly half fibres are torn	All muscle fibres torn
Weakness	Mild	Moderate to severe	Moderate to severe
Muscle spasm	Mild	Moderate to severe	Moderate to severe
Loss of function	Mild	Moderate to severe	Severe
Swelling	Mild	Moderate to severe	Moderate to severe
Palpable defect	No	No	Yes
Pain on contraction	Mild	Moderate to severe	None to mild
Pain with stretching	Yes	Yes	No
Range of motion	Decreased	Decreased	May increase or decrease

Figure J3. Visual representation of strained muscle (Pescasio, Browning, & Pedowitz; 2008).

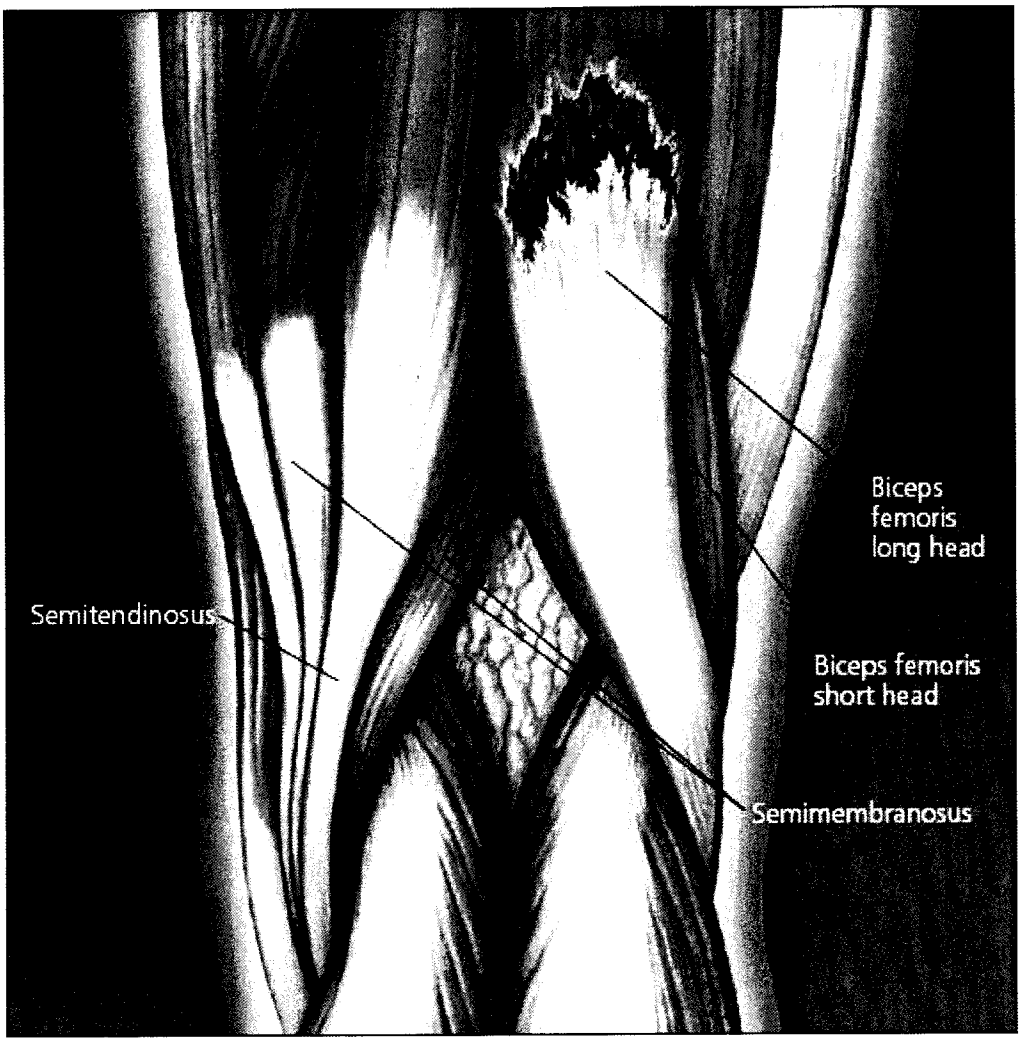


Figure J4. Visual representation of sprained ligament (Joseph & Zieve, 2008).

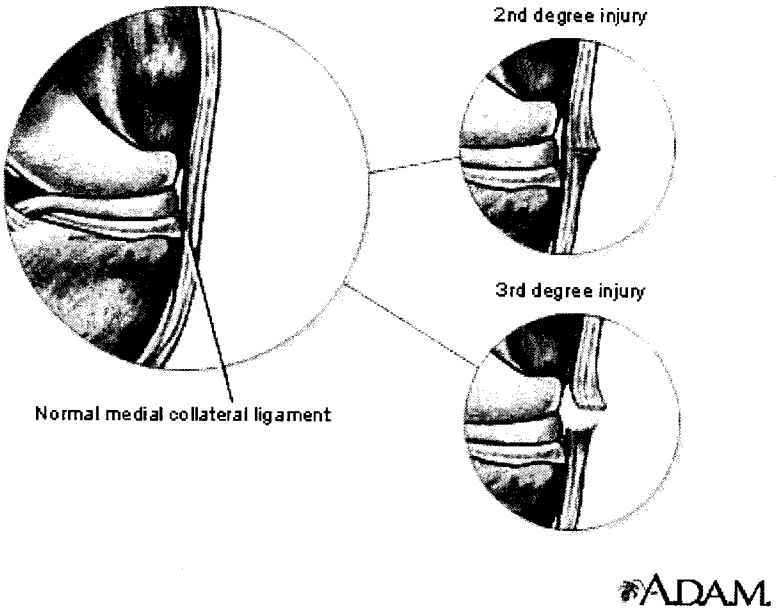


Figure J5. The basic healing process of a soft tissue injury (Anderson, Parr, & Hall, 2009).

The healing process of the body functions through 3 phases. These phases may be active at the same point in time as there is no definite beginning and end point to each:

1. Inflammatory phase

- Occurs approximately 0-6 days after the injury
- At first, in the seconds after the injury up to 10 minutes, blood vessels constrict to limit blood flow. The blood begins to clot to prevent further bleeding
- After approximately 10 minutes, blood vessels dilate as blood flow to the area begins to increase
- The increased blood flow is very important because it brings in neutrophils and macrophages (white blood cells) which come and clean the injured area of damaged cells and debris
- However, as a result of this increased blood flow, swelling occurs
- The inflammatory phase comes to an end when all the debris and damaged cells are removed by the white blood cells (see figure B6: inflammatory phase)
- The white blood cells then enter back into the blood stream and the inflammation decreases

2. Proliferative phase

- This phase begins approximately 3 days post injury and can last from 3 to 6 weeks
- This stage is characterized by the forming of a collagen matrix that becomes the framework in rejoining the 2 torn sides of the tissue

- It is referred to as a matrix as collagen fibres are initially randomly formed in all directions
- Over the weeks of repair, the collagen fibres straighten out into the direction of the commonly applied force (see figure B7: collagen fibre matrix)
- The proliferative phase also sees the vast increase in the amount of blood vessels in the injured area
- These new blood vessels attach to the collagen membranes, providing the nutrients needed for growth

3. Remodeling phase

- Occurs a year or longer after the injury
- The immature collagen fibres are increasingly replaced by stronger, more mature fibres
- The collagen fibres move completely away from a matrix and become increasingly aligned along the axis of the force

Figure J6. White blood cell action in inflammotory phase (Anderson, Parr, & Hall, 2009).

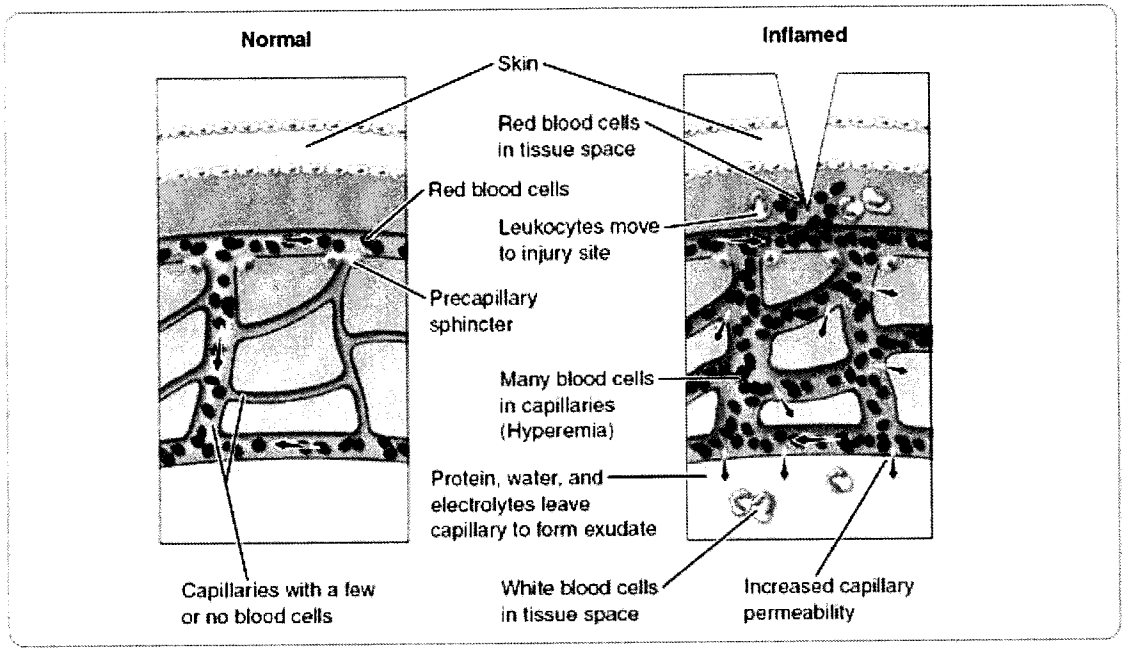
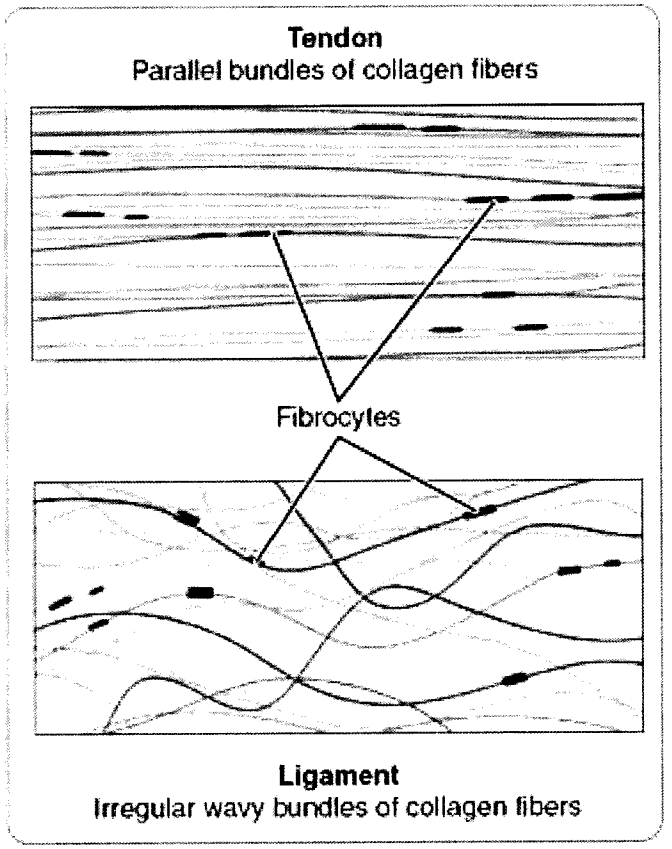


Figure J7. Collagen fibre formation in the proliferative phase (Anderson, Parr, & Hall, 2009).



Appendix K

Internal Imagery Script (Hildebrand & Frank, 1998; Porter, 2003)

INTERNAL IMAGERY SCRIPT

Internal Imagery
Shift all your attention toward your injury, it is the only thing on your mind now Feel the tightness and resistance in your leg releasing Feel the muscle tissue around your injury releasing, it is becoming soft and relaxed (Ask the participant to describe what they are imaging) Feel the ligament in your leg, it is damaged but is ready for recovery See the partially torn ligament, focus on the fibres that are disconnected from each other Feel the blood in your arteries pumping towards the injury, it is bringing new food and oxygen to the ligament (Ask the participant to describe what they are imaging) See the damaged cells being removed by the blood, being replaced with new healthy cells Feel the new blood circulating around the injury and building new tissue See the new cells forming a matrix of tissue, see the scar tissue being taken over by this new, powerful, strong tissue (Ask the participant to describe what they are imaging) See the strong, tough, indestructible collagen fibres taking over the ligament, forming into one

See the ligament or muscle coming together to make a strong, unbreakable band (Ask the participant to describe what they are imaging)

Appendix L

External Imagery Script (Porter, 2003)

EXTERNAL IMAGERY SCRIPT

External Imagery
Focus all your attention toward your ankle It is fully healed and stable, it is the strongest it's ever been Feel yourself rotating your ankle, it is fully flexible, pain free, and ready to perform (Ask the participant to describe what they are imaging) See yourself standing up in the room, there is no discomfort in your leg See yourself walking around the room, you are able to take full strides and balance on one leg, you are unaffected by your ankle (Ask the participant to describe what they are imaging) Feel your ligament, it is fully healed, it is strong and flexible See yourself, balancing on one leg, you are stable as a rock (Ask the participant to describe what they are imaging) Feel your entire body, it is strong, fit, and fully healthy Feel your body as a whole, there are no weaknesses See your body as a whole, you are strong and healthy See yourself walking through the door, you are completely healed, your body is efficient,

operating as one, pain-free

(Ask the participant to describe what they are imaging)

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